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A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. LV
No. 143

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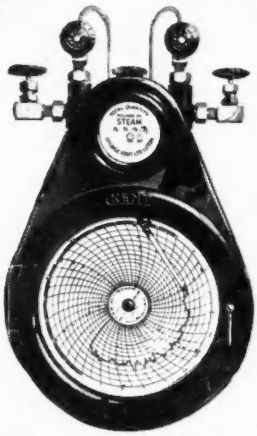

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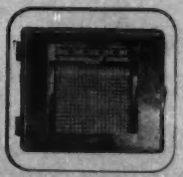

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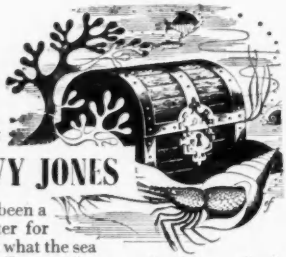

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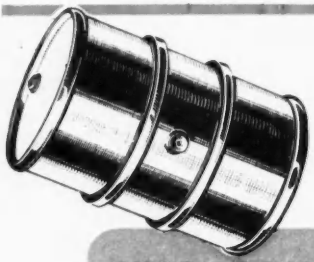

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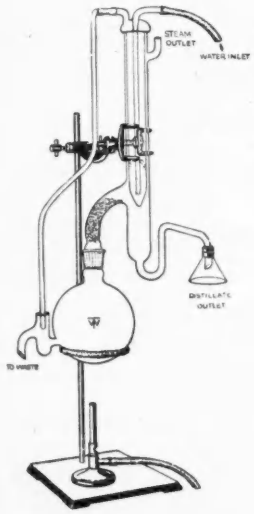

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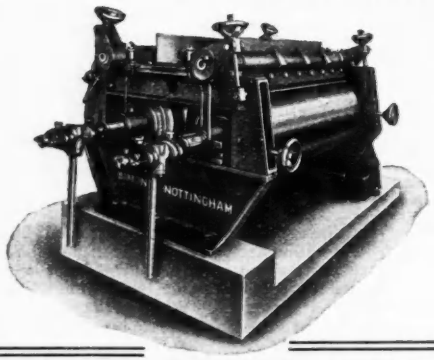

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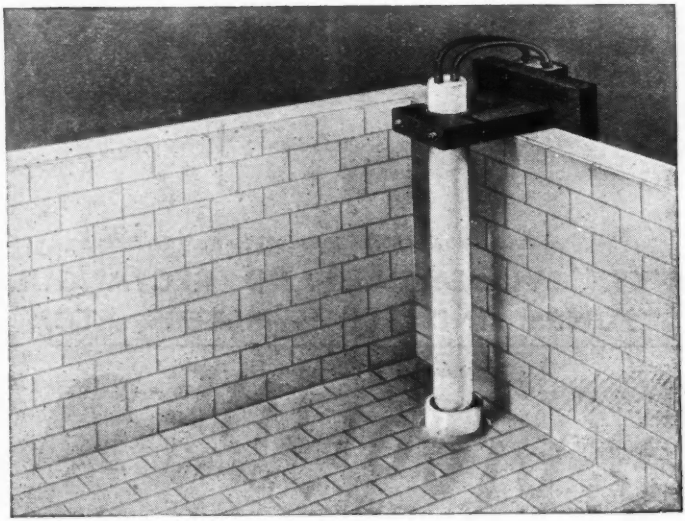

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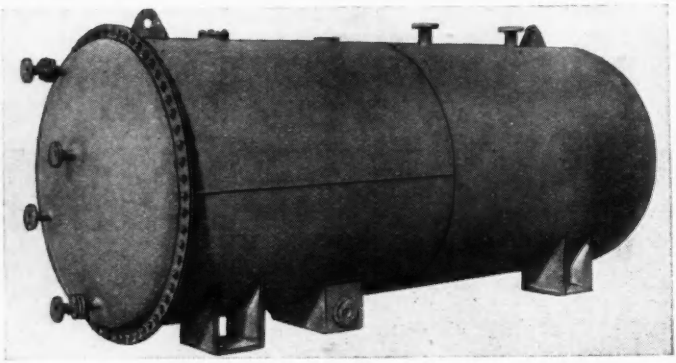

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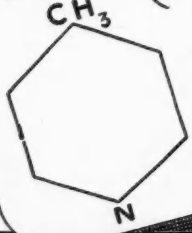

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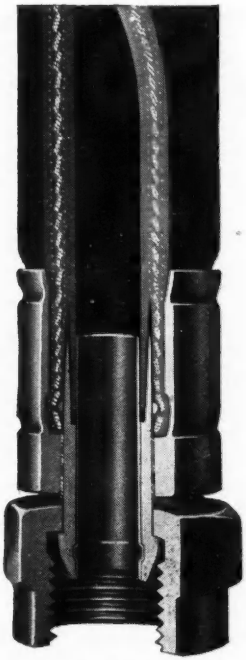

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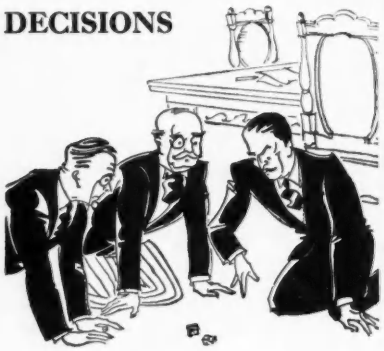

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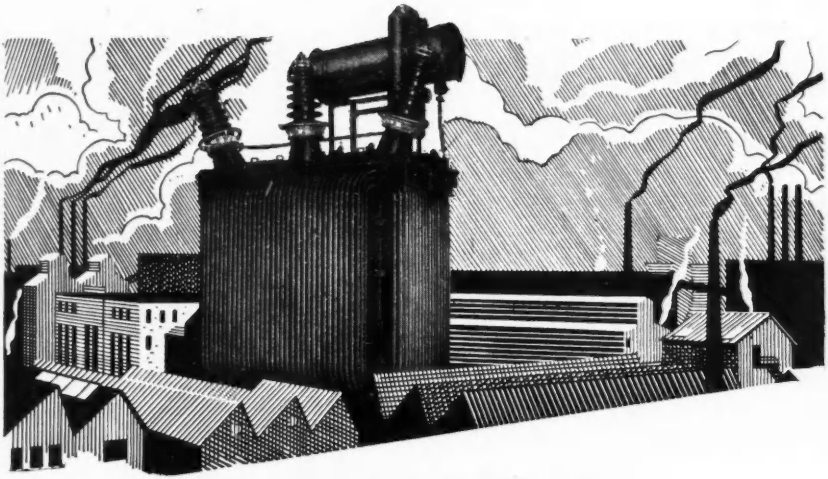

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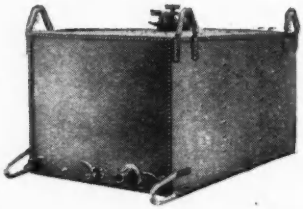

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The Apathetic Chemist

APATHY in politics is a characteristic of the British. We do not get excited about things and although we may think deeply about them, we do not always express our views. A "soul-satisfying" list of typical British qualities was published abroad by a well-known Italian Fascist during the Abyssinian war; it comprised "tea-drinking, snobbery, golf-playing, puritanism, clean-shavenness, pipe-smoking, bridge-playing, and inexplicable apathy towards women." It is not only the Italy of Mussolini that accuses us of apathy. The *Journal of the British Association of Chemists* repeats with obvious approval the charge that has been levelled against chemists—against British chemists anyway—that "as a body they are apathetic, individualistic, and unsociable." The cause of this animadversion was the recent voting in the Association upon the question of whether or not to affiliate with the T.U.C. Here we may say at once that the voting went against affiliation by a majority of 24 in a total vote of 1138. It is not the result, however, that worries the editor of the *Journal of the British Association of Chemists;* it is the fact that only 56 per cent of all the members voted upon so vital an issue. That has given rise to the editorial reflection that "nearly half the members seemingly did not care a hoot about the destiny or policy of their association, and yet possibly they join the cry, sometimes amounting to a chorus—'What's wrong with the B.A.C.?'" There is, remarks the editor, no smoke without fire, and much rhetoric is being expended to induce members of the profession of chemistry to rouse themselves.

There are many answers to this condemnation of the chemist, some are excuses, some are not so much answers as contributory factors which may help to account for the seeming indifference. It may be of interest to notice that a vote of 56 per cent does not in itself indicate any particular apathy on the part of the chemist over and above that displayed by other sections of the British public. Is the vote at local government elections any greater? Is the percentage voting at by-elections for Parliament any greater? Even at General Elections we have known the votes to be cast to be of that order of magnitude.

The vote, moreover, may be a true reflection of the opinion of the chemists of this country. The reasons for and against affiliation to the T.U.C. are nicely balanced and it is not necessarily true that either the advantages or the disadvan-

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tages are sufficiently marked to give rise to strong feelings about it; those who have no strong feelings are likely to abstain because there is present no force sufficiently great to overcome the inertia that exists in every British individual against writing and posting a letter. If we ourselves were puzzled about the rights and wrongs of an issue, should we vote one way or the other? We should not. Being reasoning human beings, we should desire that those who had studied the subject should make up our minds for us, and we should thus abstain on the ground that it is better that those who had views should express them. That may seem a negation of responsibility, but it has something to recommend it and at least shows faith in our leaders that they will take the right decision.

The chemist does not take too kindly to organised trade unionism. The B.A.C. held a Brains Trust which is reported in the same issue of the *Journal*. One answer to a question, as to why chemists do not readily co-operate to their own mutual benefit, deals with this issue fairly. The reply was to the effect that " the people who set out to be chemists were those who considered themselves to be more individualistic than those in other trades. . . . The chemist is an individualist. His apparent apathy to this question is very largely due to poor pay. But also it is not to be disregarded that being an individualist, the chemist more and more considers that he is less likely to be out of work. He has more confidence in himself than a worker in more stereotyped industry. That the chemist is an individualist is really the best answer of all." The individualist believes in standing firmly upon his own feet. The chemist is a member of the staff who expects one day to attain high position. That position may be as chief chemist, as chemical engineer, as head of some department where scientific knowledge can be put to some useful purpose, or even as general manager or managing director of the whole business. To the chemist there are open endless possibilities of advancement. A writer in an American magazine in 1940 asked and answered a question very pertinent to this discussion: " Where," he asked, " is the opportunity for the poor man to-day? Our land frontiers are gone!" His answer was: " This age is not an age of farming, but of science. New frontiers are being conquered to-day by new pioneers—our scientists, engineers, inventors, educators." The pioneers who opened the untamed West to human civilised occupation did not belong to a trade union, nor did they ask to become affiliated to any T.U.C. They fought and overcame by their own powers.

The chemist to-day is the pioneer of the brave new world that is being rather painfully hammered into shape. It is well to remind ourselves that there are other things in life besides preoccupation with material issues. Lord Dunsany, in his work, " Patches of Sunlight," has written: " We cannot add to the weight of the world by an ounce, we can only bring to it fancies; and whether they are expressed in towers by architects, or carved in jade by craftsmen in China, or written on paper by poets, it seems to me that they are the only wealth by which Earth can increase its store." The chemist and the physicist have found yet another way. They cannot, it is true, add to the weight of the world by an ounce, but they have discovered how to subtract from its weight, by the transformation of matter into energy. That in itself is as exciting an extension of the frontiers of the civilised world as ever was made by a gold rush or wild Western pioneer—Hollywood notwithstanding. Is it surprising that those who are making these and other advances through the discovery of natural phenomena should tie themselves down, label themselves as being workmen turned out to a single pattern, by taking trade union action?

We have given some of the answers to the charge of apathy. Do they add up to a decision not to join any such body as the B.A.C. or the Association of Scientific Workers or any other mutual benefit society? In our considered view they do not. The chemist may be starry-eyed; but he must be conscious of political movements that are going on around him. Technical and scientific men and women are the key personnel of the brave new world. Every Cabinet Minister who announces that he is about to nationalise something begs and prays for the help of the technical men in the industry concerned, for he knows that without their help he can do nothing. But the Cabinet, the government of this country is a highly organised body. Employers through their trade associations are highly organised. The main mass of non-professional workers—those who are described as receiving " wages " and not " salaries "—are highly

organised, and the demand for a closed shop has emphasised that organisation. The modern political conception is of large numbers of people engaged in roughly equivalent spheres of life being organised and deciding their terms of work and conditions of life by negotiation with other large organisations in other walks of life. The individualist, if he be very gifted, can walk alone, like Kipling's cat, " waving his wild wet tail in the wild wet woods " of the brave new world. But the ordinary mass of professional men, the general practitioners of medicine, of chemistry, of chemical engineering, cannot do any such thing. As well might each Britisher have stood alone to face the oncoming hordes of Hitler. In unity is strength and the sooner all professional men learn that lesson, the better it will be for them.

NOTES AND COMMENTS

NEW WORLD LIST

CHEMISTS will be pleased to hear that active preparations are being made for the issue of a third edition of the *World List of Scientific Periodicals*. The last edition of this invaluable scientific reference work, issued in 1934 and covering the years 1900-1933, is now out of print though still in constant demand. It contains upwards of 33,000 titles of journals and includes the holdings of some 180 libraries in Great Britain and Ireland. The new edition, which is designed to include all the scientific and technical periodicals that appeared during the period 1900-1947 as well as the holdings of additional libraries, will therefore be considerably larger. Librarians are being asked to co-operate as before by sending particulars of all those journals on their shelves that do not appear in the second edition or are shown there as having no location in this country. Information should be sent to the Secretary, World List of Scientific Periodicals, c/o The Zoological Society of London, Regent's Park, London, N.W.8, from which further particulars can be obtained.

PLAN FOR THE DONBAS

A CORRESPONDENT of *The Times* in the Ukraine, who has visited the great industrial Donbas region, has reported on the German destruction and Russian rehabilitation of this important coal-producing area. Nowhere, he says, was German destruction so systematic, and they set about their planned destruction of industry with incredible fury. Pits were flooded; and machines and even miners themselves were flung down the shafts. Thousands of electrical motors were removed and scarcely a single public building or residential block survived. When the Germans left, the population had shrunk from 3,000,000 to 1,500,000, and compared with pre-war figures the area was capable of producing only 6 per cent of its coal and 2.4 per cent of its pig iron. But in three years the reconstruction effort has been little short of miraculous, and has taken the Donbas halfway back to normal. Of greatest interest in this struggle to rehabilitate one of Europe's principal industrial areas are the incentives offered to labour, and the emphasis laid on the provision of cultural amenities for the workers. Apart from the opportunities for rapid promotion, incentives take the form of an individual bonus for high output and a collective bonus for enterprises which attain the set figures. In some cases these bonuses have increased earnings four-fold. Each miner receives a daily bread ration of 1 kg. and a meal containing 100 gr. of fat before his shift. If the planned production is reached then he gets an extra 200 gr. of bread. A factor in the rehabilitation of the Donbas is the plan to erect a network of light industrial enterprises to produce most of the locally needed goods. It is believed production can be increased in this way and the manpower shortage overcome. The authorities expect that factories for stockings, shoes and clothes will be in mass production by 1950. According to the correspondent, there has been a tremendous moral effect in the Ukraine from the announcement in simple and unambiguous terms of the plan for this area.

TRADE WITH AUSTRIA

ONE of the conclusions reached by the British Trade Mission which went to Austria recently—as mentioned in THE CHEMICAL AGE last week—was that this country could render Austria real help in the giving of technical advice on modern production technique. Judging by the avidity with which the technical reports from the Intelligence Committees in Ger-

many are studied in certain quarters, we rather thought the boot might have been on the other foot. Mr. C. F. J. Ramsden, Overseas Director of the Federation of British Industries, who led the Mission, said the members felt that, taking the long-term view, the Austrian economy had considerable possibilities. Immediate difficulties, however, were great, and the Mission had directed its attention to ways and means of getting the ball rolling. In their individual inquiries members of the Mission discovered a number of bottlenecks which were holding up Austria's exports and ability to earn foreign exchange, and it is their hope that they might do something to ease these difficulties. They also felt that there were considerable possibilities of importing from Austria goods badly needed in this country, and propositions to this end would be put to their associations. Most of the members of the Mission—which included Mr. J. Davidson Pratt, director and secretary of the Association of British Chemical Manufacturers; Mr. N. E. Rollason, of the British Iron & Steel Federation; and Mr. H. L. Stubbs, of the British Non-Ferrous Smelters' Association—visited important factories in the provinces, and they were all unanimous in praise of the courtesy shown to them by the Austrians and the arrangements made for the Mission by the Economic Division of the British Element of the Allied Commission for Austria.

THE MODERN STUDENT

IN these columns last week we commented on a newspaper correspondent's dismay at finding among present-day university students far more earnestness than was usual in his (pre-war) university days. He thought the old light-hearted spirits and broad interests were disappearing, to be replaced by a spirit of austerity and even utilitarianism. Now Sir D'Arcy W. Thompson, Professor of Natural History at St. Andrews University, has come to the defence of the present-day students. In a letter to *The Times*, he gives it as his opinion that the modern urge for serious study is far better than what he termed the old "reluctant drudgery," which caused the lecture rooms to be half empty. He tells us that he now teaches 90 students, twice as many as before; but more important than mere numbers, he suggests, is the new spirit in the air. In other years the university reading rooms stood all day empty till terminal or degree examinations were at hand; now they are full and even crowded all day long. "In short it seems that reluctant drudgery has given place to studious industry." Sir D'Arcy Thompson believes that the young men and women ex-Service undergraduates have had time during their few years in the Forces to shake off the "paralysing and stultifying" influence of the schools. Schoolboys come up to college bored and stale; they have had too little encouragement to think, and too little opportunity to read; they have learned lessons and nothing more. He remembers when he left school for the university how he used to run to lectures, wondering what new and delightful things they would be shown that day. He now sees something of this happy, eager, curiosity again in young men and women who have begun to forget the schoolmaster's routine, and begun to taste the delights of learning.

MATURER MINDS

WE believe that Sir D'Arcy Thompson is right, but he has overlooked another important factor which makes for a more studious—and probably happier—life at the university. This is that these ex-Service men and women have matured, their minds have been enlarged and they can take full advantage of all the amenities, cultural, social and sporting which a university offers to them. And above all they can appreciate and really understand what they are learning. That, in our opinion, was the reason for the proposal put forward before the war, not to admit students to the university until they had been out in the world of commerce or industry for one or two years. We do not remember any suggestion then that students should enter the Services before going to the university, but it does appear from the present-day undergraduates that their Service life has broadened their outlook as much as would have been the case if they had gone into industry.

British Guiana's exports of balata between January 1 and August 31 this year were confined to the United Kingdom (374,611 lb.) and British possessions (900 lb.). The U.K. received no bauxite from the colony, although 29,894 lb. were exported to the United States and 647,260 lb. to Canada. One thousand bags of charcoal arrived in the U.K. here from British Guiana during the same period; and 1,887,397 gallons of molasses were among the colony's other exports to the U.K.

GERMAN USE OF LOW-GRADE FUEL WITH RICH OXYGEN

by D. D. HOWAT, B.Sc., Ph.D., F.R.I.C., A.M.I.Chem.E.

THE introduction in 1930 of the Linde-Frankl process for the production of oxygen made possible far-reaching developments in the utilisation of several types of low-grade fuels in Germany. Brown coal, containing 25 to 35 per cent of moisture, which occurs in extensive deposits in Germany, has been for years a real challenge to the German fuel technologists to perfect methods of efficient utilisation. A further spur to action arose from the adoption of the low-temperature carbonisation of brown coal and other low-grade fuels yielding tar for hydrogenation to petroleum and lubricating oils. The coke residues, with high ash content, are not suitable for many of the usual purposes and special methods of utilisation had to be investigated. There is little doubt, however, that the controlling factor in the progress which has been made has been the availability of relatively cheap and abundant supplies of oxygen from the Linde-Frankl plants. Without this the German fuel technologists would have experienced much greater difficulties. It is interesting to note that there is another close relationship between the supply of oxygen and the utilisation of low-grade fuels in that the greater part of the electric power requirements of the Linde-Frankl plants were met from power stations specially designed to burn these low-grade fuels.

Low Cost of Oxygen

Some picture of the vast scale on which these oxygen plants were planned may be obtained from the I.G. Farben plants at Leuna, where the total oxygen capacity was 829,000 cu. ft. per hour at 98 per cent purity. Over the five years from 1938 to 1942 actual output of oxygen averaged 770,000 cu. ft. per hour. Costs, in terms of British currency, were extremely low; power at 1.1 to 1.2 pf. per kWh was only about 0.2d., even taking the rate of 12 RM. equal to £1. This figure is only about one-third of the present day price in Britian. On the same conversion basis the cost of the oxygen at 1.6 to 2 per cent per cu. m. works out at only 1s. per 1000 cu. ft. If oxygen could be made available in this country at anything approaching these figures, many most attractive applications would become possible.

Whatever significance may be attached to the German cost figures, the magnitude of the utilisation of high purity oxygen is beyond doubt. In view of the outstanding progress made, it is imperative that considerable attention should be paid to this record of German achievement. The fuel situation in this country is sufficiently serious to justify the exploration of every possible way of utilising low-grade fuels. In the near future it may become necessary to consider seriously the treatment of pit bings for the recovery of fuel values. Many of these bings were laid down at a time when coal was plentiful and cheap and low-grade fuel commanded no market. A combination of crushing and concentration, say by rough flotation, may yield quite valuable revenues of fuel. Washery residues and sludges are another possible source of low-grade fuel. Finally, the relatively large deposits of peat in Britain, particularly in Scotland, must be regarded as a commercial asset. Lessons from the German methods of utilisation of brown coal may be of great value in this connection.

Water-Gas Production

For the present, only the gasification of low-grade fuels by oxygen will be considered in the light of the recent information available from Germany. The outstanding advances appear to centre in the use of an oxygen/steam mixture in place of the air/steam mixture commonly adopted. In the manufacture of water-gas, valuable both as a fuel and as the starting point for chemical synthesis, the great advantage of the process lies in the continuous production of gas from a generator in place of the cyclic "make and blow" process hitherto employed when utilising air in conjunction with steam. Gas produced during the "blow" period has a very low thermal value and is frequently vented to the atmosphere.

Two interesting and significant pieces of plant have been developed for water-gas production by using oxygen—the Winkler "boiling bed" generator and the "slagging" generator. Some of the main features of both these plants will be discussed.

High pressure gasification of fuel has frequently been proposed but the development by the Lurgi group of a high-pressure gasification process utilising oxygen and steam appears to constitute the first commercial success for a process of this type. Extremely useful information relating to this process has recently been made available and will be discussed briefly.

When oxygen and steam are blown through an incandescent bed of fuel the

oxygen content of the blast will largely determine the temperature of the fuel bed and, in consequence, the physical condition in which the ash is discharged. On this basis water-gas generators may be divided roughly into two types—the shaft generators, in which the oxygen content is maintained at a value insufficient to fuse the ash, which is discharged through the grate or carried over as "fly ash." On the other hand, in the "slagging generators" the

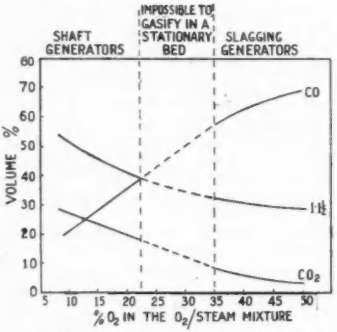

Fig. 1. Gas analysis as a Function of the oxygen content in the blast (SABEL).

oxygen content of the blast maintains a fuel bed temperature sufficiently high to melt the ash, which is tapped off as a slag. A complicating factor in this classification is the ash fusion temperature. With certain ash compositions it may prove very difficult to utilise an oxygen enriched blast without serious danger of clinkering and fusion occurring. Apart from this limiting factor the oxygen content of the blast is crucial in the continuous production of water-gas, as indicated in Sabel's data[1] in Fig. 1.

While the data given refer exclusively to stationary bed generators (and exclude the Winkler generator), it may be noted first that the upper limit of oxygen in the blast to a shaft generator is about 22.5 per cent. Sabel states that certain modifications of generator will give a low carbon in the ash with a high fuel bed temperature, even if the slag is beginning to soften. Then, as indicated in Fig. 1, with 22.5 to 35 per cent of oxygen in the blast it did not prove possible to gasify fuel satisfactorily in a stationary bed. With oxygen contents of over 35 per cent in the blast, slagging generators must be employed. The upper limit of oxygen (55 to 60 per cent) is reached with normal cokes and semi-ash. With these high oxygen contents the high fuel bed temperatures produced result in severe attack on the constructional materials of the generator.

Other important factors varying largely with the oxygen content of the blast are the quantities of steam consumed and the percentage of steam decomposition secured. As shown in Sabel's data in Fig. 2, the steam consumption decreases markedly with increase in oxygen content of the blast and with the higher fuel bed temperatures, yet the oxygen consumption per unit volume of ($CO + H_2$) is not increased. Further, as the steam decomposition increases with the oxygen content of the blast, the output of combustible gas per unit of shaft area also increases. In consequence, the aim is to carry as high an oxygen content in the blast as possible compatible with the life of the refractory lining of the generator.

By far the greatest volume of research and development work relating to the use of the oxygen/steam blast in water-gas production was carried out at the I.G. Farben plant at Leuna, where the first Winkler generator was installed in 1926.

The basic principle of the Winkler generator is not the use of an oxygen/steam blast but the employment of relatively small-sized particles of fuel to constitute a bed which is kept in suspension or "boiling" by a blast of air alone or a mixture of air and steam. Such a procedure would, it was claimed, result in a very greatly increased output of gas from a given area of hearth. At Leuna the original Winkler was planned to operate on particulate brown coal using the normal "make and blow" cycle with air and steam. Sabel[1] reports that the

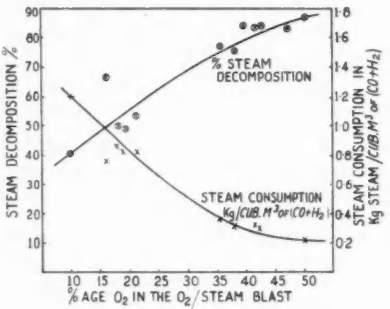
STEAM DECOMPOSITION %
% STEAM DECOMPOSITION
STEAM CONSUMPTION Kg/CUB.M²or(CO+H2)
STEAM CONSUMPTION IN Kg STEAM/CUB.M² or (CO+H2)
% AGE O2 IN THE O2/STEAM BLAST

Fig. 2. Steam consumption and decomposition in relation to oxygen content of the blast (SABEL).

major difficulty in operating the Winkler generator on the "make and blow" cycle is the maintenance throughout the cycle of the correct velocity of air and steam so that the bed is maintained continually in suspension. Even comparatively small fluctuations in the velocities are troublesome, a decrease allowing the bed to become quiescent while

a small increase may result in blowing a large proportion of the charge up the chimney. Obviously, the difficulties of maintaining the correct velocity through the bed may be reduced if a continuous oxygen/steam blast is employed instead of the intermittent "make and blow" cycle. As a result of these difficulties, experiments directed to the utilisation of a continuous oxygen/steam blast, were started in Leuna in 1929.

A diagrammatic sketch of the Winkler generator finally developed is shown in Fig. 3.[2] As indicated in the diagram, the fuel is introduced into the fire bed by water-jacketed screw conveyors, three of which are provided on each generator, entry of the fuel being effected at a point about half-way up the fuel bed. Distribution of fuel within the bed is effected by the "boiling" action of the blast. Travelling chain grates, originally fitted, proved quite unnecessary and were replaced by stationary fire-brick grates. Damage to the fire brick by slag adhesion and the mechanical action of the stirrers made it necessary to substitute cast-iron bricks in the grates. A typical stationary grate is made up of wedge-shaped bars, 400 mm. long, 125 mm. deep, 35 mm. wide, packed in groups of three, a 1.5 mm. space being left between each group of three bars. Adequate distribution of oxygen and steam was secured by this arrangement.

Immediately above the grate a water-cooled stirrer arm rotates at about 1 to 2 r.p.m., the main function of the stirrer being to sweep larger pieces of ash and clinker towards one or two specially prepared holes in the grate. Discharged through the grate, the pieces of clinker are withdrawn from the generator by two water-cooled screw conveyors. Ash withdrawn by this means represents about 10 to 20 per cent of the total ash in the fuel feed and carries 30 to 50 per cent of carbon. The remainder of the ash is carried over by the gas produced as "fly ash." The entire grate assembly, comprising the grate, the stirrer mechanism, the wind-box, and the conveyors, may be disconnected from the generator, dropped on to a bogie and removed to the maintenance shop for repair and replacements. A spare grate is then inserted.

Grateless Generator

It is reported that a grateless generator has been developed at Leuna, but detailed information is not available. Apparently the base of the generator is made in a conical form, oxygen and steam being introduced through tuyeres fitted about half way up the cone. No stirrer is provided, ash discharge being secured by two screw conveyors in the base, the conveyors being run intermittently.

It is claimed that the grateless generator effected a saving of 10 per cent in both oxygen and fuel consumption for the same production of gas.

The depth of fuel in the "boiling" bed is maintained at 1 to 1.5 m., being controlled by the rate of addition of fresh fuel. Fuel feed control is manual, the operator working to the pressure difference across the fire-bed, this difference being proportional to the depth of fuel. Maintenance of the correct depth of fuel bed is extremely important as, with a fall in level, oxygen may "break through" into the water gas with serious danger of explosion in the pipe lines. Too thick a bed causes an excessive pressure drop, with the danger of the bed becoming quiescent. With a quiescent bed excessive ash fusion on the grate occurs.

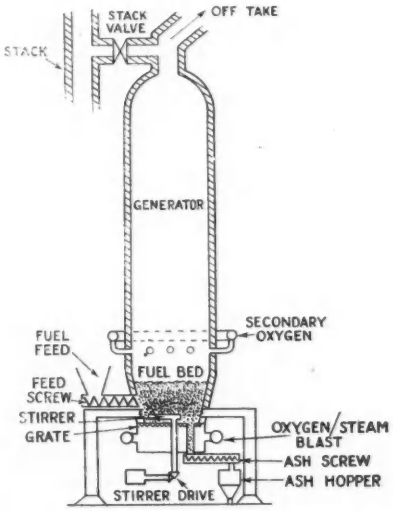

Fig. 3. Modern type of Winkler generator at Leuna (BIOS FINAL REPORT 333).

Fuel bed temperatures are maintained as high as possible to minimise carbon dioxide formation, but the attainable temperature is fixed by the fusion point of the ash, which usually sets the upper limit at 900 to 1000°C. Temperature control is exercised by adjusting the proportions of oxygen and steam in the blast.

Adequate mixing of the oxygen and steam is essential to successful operation of the Winkler generator and it is recommended that the mixing should be effected at a point in the pipe line at least 10 to 15 m. distant from the generator, preferably incorporatng a restriction plate or bend in the line. Failure to secure good mixing

causes increased local heating on the grate with excessive clinker formation. Permissible oxygen content in the blast may vary from 20 to 50 per cent.

Secondary oxygen added above the fuel bed, as shown in Fig. 3, serves two purposes. First, it helps to burn off some of the finely divided fuel particles blown out of the bed along with the "fly ash." Second, it raises the temperature of the gases so that cracking of the tars and hydrocarbons may occur together with further reaction between excess steam, carbon dioxide, and finely divided fuel. The fraction of the total oxygen blown in above the fuel bed may vary from 10 to 33 per cent. Steam may also be blown in at this zone, but in smaller ratio than in the blast underneath the grate.

The volume of the generator above the fuel bed is important, as it governs the time available for completing the reactions outlined above. Normally, the volume of generator space is about 15 times that of the actual fuel bed, giving an actual contact time between gas and suspended fuel particles of the order of 7 seconds. In the original type of Winkler generator the top was constructed in a bulbous fashion, but all the later types have been made straight-sided but of appropriately greater height, so simplifying the construction.

Gas Control

Water cooling must be provided on the tuyeres through which the secondary oxygen is blown in and the gas velocity must be controlled within very close limits to prevent the intensely hot flame damaging the brickwork opposite, or around, the tuyeres.

As a result of this design, the gases leave the generator at a rather higher temperature than that of the fuel bed, average gas outlet temperature varying from 950° to 1050°C. In addition, the exit gases carry about 80 per cent of the total ash in the fuel feed as "fly ash," while unburned carbon also escapes with the exit gases, the total amounting to 20 to 50 per cent by weight of the feed.

Provision is therefore made to secure waste-heat recovery and to precipitate "fly ash" from the gases. Exit gases from the generator pass downward through a long brick-lined pipe—a characteristic feature of the installation—to the waste-heat boiler. Water-tube boilers are employed raising super-heated steam at about 260 lb. pressure, the lower drum being insulated and hung in the gas space. After passing over the boiler tubes, dropping in temperature to 400°C., the gases flow through an economiser. In view of the dangers of erosion, the gas speeds through the boilers and economisers should be maintained below 8 m. per second. The weight of steam generated is at least equal to the weight introduced into the generators but, as the steam from the waste-heat boilers is at high pressure, it may be used as a source of power before being exhausted at a pressure of 10 to 25 lb. to the generators.

Dust removal is effected by multicyclones through which the gases pass after leaving the economisers. Electrostatic precipitators have been tried out at several plants, but these have apparently proved less efficient than the multicyclones, which are now standard equipment at all the installations. Even with high dust contents of 1400 grains per 1000 cu. ft., the multicyclones have proved to be 80 per cent efficient. Passing through a small water-seal (purely a safety measure) the gases are fed to water-scrubbers and then to Thyssen disintegrators, the dust content of the exit gases being 0.8 to 2.0 grains per 1000 cu. ft.

Profit and Loss

Ten to 14 per cent of the total carbon charged to the generator escapes with the "fly dust," which, over a year, was found to have the following analysis: carbon 54.3 per cent, ash 43.8 per cent, and C.V. 5000 T cals. per ton. This material is normally employed as a boiler fuel. Apparently the price of this fuel is sufficiently low for the loss of this percentage to be accepted with equanimity, provided a reasonable credit is obtained for its use as boiler fuel.

The exact economics of the Winkler generator are not easily assessed, first, because there is nothing in this country comparable to the two main fuels utilised—dry brown coal and "grude coke" (the product of low-temperature carbonisation of brown coal). The price of brown coal is 1 to 3 RM. per ton, while the cost of dried brown coal is 4 to 9 RM. per ton. It is estimated that the marginal "grude coke," utilised in the Winklers, was taken at the value of the cheapest alternative fuel, *viz.*, dried brown coal at 4 to 9 RM. per ton. As duff, washery slurry, and coke breeze, the cheapest available fuels in this country at the present time, are commanding 27s. to 33s. per ton, fuel costs would be at least twice those obtaining in German practice. The other very uncertain feature is the price of oxygen, which in this country is 8 to 12 times the German figures. In this connection, Sabel,[1] states that the price of water-gas (based on the CO plus H_2 content), made from hard coke when using oxygen gasification, is approximately 10 per cent higher than when using the normal "make and blow" method. The saving in coke effected by the use of oxygen and the simpler plant for continuous gasification does not balance the cost of the oxygen required—at the present price of oxygen, *viz.*, 1.2 to 2.0 pfennig per cu. m. (approximately 1s. per 1000 cu. ft.).

Also, when all the gas is to be converted

to hydrogen, the total steam requirements are higher, adding another cost item to the total. This factor is clearly shown in Sabel's calculations, converted into British units and shown in Table III (*see* p. 668).

A further disadvantage of the Winkler generator is the heavy capital cost involved in the provision of a liquid air plant for the supply of oxygen. Arising in this connection is the question of gas production per unit area of site. At two of the newest German installations the total site area involved—including fuel handling, waste-heat boilers, coolers, etc., but excluding the air liquefaction plant—was about 50 sq. m. per 1000 cu. m. per hour of CO plus H_2 (approximately 17 sq. yd. per 1000 cu. ft.) of installed capacity. In comparison, a coke water-gas plant operating on the conventional "make and blow" cycle would require a very similar area—roughly 14 to 20 sq. yd. per 1000 cu. ft. of gas.

Advantage of Winkler Process

As already indicated, the process has a relatively poor thermal efficiency, up to 50 per cent of the carbon in the charge being carried off in the "fly ash." That this dust may be utilised for boiler firing, with the granting of an appropriate credit, does not affect the thermal efficiency of gas production.

Finally, all processes using oxygen gasification have an added disadvantage in that any oxygen in the blast must eventually appear as carbon dioxide in the gas. Heavier compression and scrubbing costs are therefore involved in the elimination of this higher carbon dioxide content.

The supreme advantage of the Winkler process lies in the ability to utilise low-grade fuels, the gasification of which by any other method would be extremely difficult or almost impossible. For this reason a strong case may be made for the serious study of the process in this country, with particular reference to the utilisation of such low-grade fuels as washery sludges, carbonaceous shales, pit-bing shales, coke-breeze, and peat. Water-gas obtained from the Winklers may be expected to have a calorific value of about 200 to 250 B.Th.U. per cu. ft. Such a gas would prove of considerable value industrially as a fuel, while the carbon monoxide and hydrogen contents are sufficient to warrant its consideration as a basis for chemical synthesis. While the calorific value is rather low to justify extensive distribution of the gas through a gas-grid, there are good grounds for believing that methanisation may be comparatively easily effected, yielding a gas eminently suitable for transmission through a grid.

Two operating advantages are offered by the Winklers in contrast to the usual type. First, Winkler units may be made with a very large capacity. Outputs of 1¾ million cu. ft. per hour may be secured, in contrast with about 280,000 cu. ft. per hour with the largest coke water-gas generators. This factor is particularly valuable in the treatment of small-size particles of low-grade fuels. Second, the output of gas per unit of grate area is very high—32,000 to 45,000 cu. ft. per sq. ft. of hearth area, compared with about 2500 cu. ft. per sq. ft. of hearth in the coke water-gas generators.

Figures showing the performance of typical Winkler generators and the consumption of fuel, steam and oxygen are tabulated in Table 1.

TABLE I.

PERFORMANCE OF WINKLER GENERATORS PRODUCING WATER GAS BY USE OF THE STEAM/OXYGEN BLAST AND EMPLOYING "GRUDE" COKE OR DRY BROWN COAL.

	"Grude" Coke	*Dry Brown Coal*
Fuel employed :—		
Actual production of Water Gas per hour per unit (cu. ft.) ...	1,765,000 to 2,118,000	955,000
Fuel Analysis :—		
Carbon	68.0%	59.3%
Hydrogen	2.0%	4.4%
Oxygen	2.2%	15.2%
Nitrogen	—	0.7%
Volatile sulphur ...	1.3%	3.3%
Ash	26.5%	16.7%
Water	2.0%	8.7%
C.V. (B.Th.U. per lb.)	10,700	9,300
Final size grading ...	Av. 3 mm.	Av. 3 mm.
Analysis of Gas produced :—		
CO_2	20.0%	21.8%
CO	37.5%	35.3%
H_2	39.5%	38.5%
CH_4	1.5%	1.8%
N_2	0.5%	1.1%
H_2S	1.0%	1.5%
C.V. of gas (B.Th.U. per cu. ft.)	224	222
Oxygen in total blast ...	40% to 50%	40%
Fuel bed temperature ...	850° to 900° C.	—
Gas exit temperature ...	900° to 950° C.	—
Gas temperature after waste heat recovery ...	200° C.	—
Dust content of gas (lbs./1,000 c. ft.)	7.5 to 15	6.9
Supplies required (per 1,000 cu. ft. of gas produced) :—		
Fuel (lbs. per 1,000 cu. ft.)	39.8	51.7
Carbon (lbs. per 1,000 cu. ft.)	26.6	28.1
Oxygen (cu.ft. per 1,000 cu. ft.)	320 to 335	336
Steam (lbs. per 1,000 cu. ft.)	22	25.4
Steam raised (lbs. per 1,000 cu. ft.) ...	36.2	37.4
Steam decomposition ...	—	33
Carbon utilisation ...	88	86.5
Dust blown over with gas (lbs. per 1,000 cu. ft.) ...	10 to 16	9.3
Grate ash	—	2.56
Power (excluding oxygen production) (kWh per 1,000 cu. ft.)	—	1.36

(British equivalents given above have been calculated from the original German Data embodied in *BIOS Final Report No.* 333.)

Some experimental work was carried out at Leuna[1] on the oxygen gasification of hard "grude coke" in stationary bed producers of the usual type. In those circumstances the performance should approximate to the

data given in Fig. 1, a fact which proved substantially true in practice. Again, the cost of oxygen proved the most difficult economic problem, while this advantage was not outweighed by the utilisation of very low-grade fuels, as was possible in the Winklers.

Following upon the development of the Winkler generator at Leuna, experiments were begun to gasify "grude" coke or hard coke in a generator with a fixed grate, the oxygen content of the blast being maintained sufficiently high to fuse the ash produced. Six of these slagging generators were built at Leuna,[1] each with a capacity of 450,000 cu. ft. per hour of substantially nitrogen-free gas. The generators were constructed of ½ in. steel plate, the diameter at the tuyeres being 2.5 m., tapering to 3.8 m. at the widest part. Overall height of the generator is 7 m. above the tuyers, while the fuel bed is maintained at a thickness of about 4 m. above the tuyere line. The top part of the shell, above the fuel bed, was lined with refractory, a similar construction being utilised in the crucible part

TABLE II.

FIXED-GRATE SLAGGING PRODUCERS USING OXYGEN AND STEAM FOR GAS PRODUCTION AT LEUNA.

Type of Fuel used	*Ash Product from usual make and blow generator (50% Carbon)*	*"Grude" Coke*	*Metallurgical Coke*
Gas Analysis :—			
CO_2	9.7%	5.4%	6.8%
CO	66.5%	62.4%	61.4%
H_2	22.9%	31.2%	31.0%
CH_4	0.0%	0.0%	0.0%
N_2	0.9%	1.0%	0.8%
H_2S (gms. per cu. m.)	2.7%	13.0%	4.3%
Requirements (per 1,000 cu. ft. of producer gas made) :—			
Oxygen (cu. ft.) ...	347	276	262
Steam (lbs.) ...	13	17	21
Fuel (lbs.)	...(not given)	50	30
Carbon burned (lbs.)	(not given)	30	26.6
Fuel Analysis :—			
Carbon	45/50%	54%	86.8%
Ash	55/40%	16.9%	9.1%
Moisture	Nil	22.0%	1.8%

of the generator from the tuyere line down to the bottom. Around the actual fuel bed the generator is unlined, some being fitted with water cooling jackets and others cooled by water-sprays. Apparently the existence of the water-jacket had caused serious trouble on one occasion when a leak caused the converter to be extinguished and oxygen, entering the pipe line, caused a serious explosion.

With an oxygen/steam blast the temperature in the tuyure zone was about 1700°C., exit gas temperature being about 400°C. When necessary, limestone may be added as a flux, the slag formed being tapped off at intervals of 20 to 60 minutes.

At Leuna the main fuel employed was the waste product (Rohschlacke) from the ordinary "make and blow" generators. This product contained about 50 per cent. of carbon. With this material as fuel the oxygen in the blast could be maintained at 50 to 58 per cent, but with metallurgical coke the oxygen content had to be reduced to about 35 per cent. To flux the ash from metallurgical coke, 3 per cent of limestone and 20 per cent of slag from previous runs were added.

Typical operating results from the slagging producers when operating on three different fuels are shown in Table II.

While the development of the Winkler generator made possible the complete gasification of brown coal or "grude coke" by the utilisation of the oxygen/steam blast, similar treatment of low-grade non-coking bituminous coal presented rather different problems. Published work, available before the war, indicated that a number of the problems had been solved in a semi-scale Thyssen-Galocsy slagging producer at Duisburg-Hamborn. This plant, of 2 tons per day capacity, was later supplemented by a 10-ton per day plant at the ammonia synthesis plant at Pecs, Hungary.

According to the literature, the essential features of the producer were the admission of oxygen at two or more levels, in an endeavour to spread the reaction zone, and, second, the recirculation of a portion of the exit gas and its re-admission through the tuyeres. It was claimed that this re-circulation of the exit gases enabled better reduction of the carbon dioxide to be secured and prevented excessive localised over-heating by the oxygen blast.

Large Generator

The recent CIOS report[2] gives very useful data relating to a 40-ton-per-day generator built during the war at the *Krupp Treibstoffswerk Wenne Eickel*. According to the information obtained, this generator was erected because the semi-scale unit at Duisburg-Hamborn was not sufficiently large to furnish conclusive data on the results obtainable in the gasification of various fuels. It was hoped to demonstrate in the 40-ton unit that it was feasible to gasify any grade of fuel in any combination of sizes from 5 mm. to 80 mm. whether coking or non-coking and regardless of the ash-flowing temperature.

As will be evident from the drawing in Fig. 4, the 40-ton unit was shaped like an iron blast furnace, being about 35 ft. in height and 10 ft. in diameter at the bosch. Provision is made for three levels of tuyeres, five tuyeres being fitted on each level. The tuyeres at the lowest level are actually water-cooled burners in which the re-circulated producer gas is burned in the mixture of oxygen and steam. The products of combustion are then admitted to the generator, having reached a temperature suffi-

ciently high to enable the steam and carbon dioxide to react with the carbon of the charge. The percentage of the total make of gas re-circulated to the tuyeres appears to vary from 12 to 16. The tuyeres at the upper levels are not water-cooled, being utilised only for the admission of additional oxygen. This secondary oxygen is employed to provide additional heat to balance that required for the reduction of the steam and carbon dioxide and to melt the ash. Only one level of tuyeres is utilised for the admission of oxygen at any one time, the choice of level being determined by the combustion conditions obtaining.

The principal aim is to spread the zone of combustion and to reduce the localised high temperatures in an attempt to prolong the life of the refractories.

While the greater part of the interior of the generator is lined with firebrick, a band of carbon blocks 1 m. wide is inserted round the bottom of the shaft to resist the corrosive action of the slag. The slag tap-hole is located at a height of 650 mm. above the bottom of the shaft, while any metallic iron reduced from the ash is drawn off through a tap-hole at the bottom of the shaft. A further modification in the fire-brick lining is the insertion of two tiers of steel water-jackets around the shaft just above the lowest set of tuyeres. The water jackets are arranged in two tiers of 10 segments each, the two tiers being necessary to permit of the replacement of any damaged or leaking segment.

A cylindrical hollow steel shaft is fitted vertically in the upper zone of the generator to equalise gas resistance throughout the total cross sectional area of the fuel bed. Fuel charged by the bell falls into the annular space between the wall of the generator and this steel shaft. The shaft is made in two sections, each 2000 mm. long, the upper being 1200 mm. in diameter and the lower 1500 mm. in diameter. A truncated hollow cone is fitted to the top of the shaft, while the lower part is connected to the upper part of the shaft by a conical expansion piece. This arrangement is claimed to eliminate the tendency of the gases to rise up through the charge along the wall of the generator. By banking up the charge along the wall the resistance of the centre of the fuel bed is decreased to the point where it is more or less equal to, or even less than, the resistance along the wall.

Piping arrangements required are fairly complex to allow any combination of operating conditions to be met. Steam is admitted to the oxygen line at a considerable distance from the generator to ensure

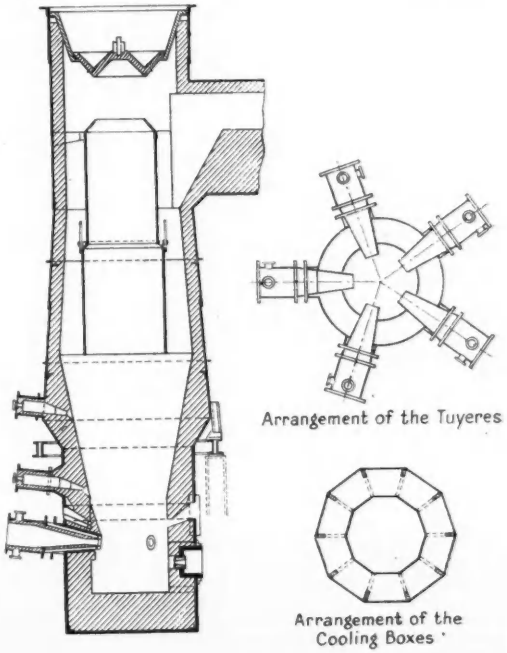

Fig. 4. Thyssen - Galocsy slagging generator at Wanne-Eickel (CIOS FILE No. XXIX-51).

thorough mixing, while the oxygen is passed through a water-seal to act as a barrier to the passage of gas from the generator back into the oxygen line.

Many different types of solid fuels have been tried out on the 40-ton unit, including coke, non-coking coal and waste material from the conventional generators. A test of four weeks' duration proved that no operating difficulties were experienced with coke of 40 to 60 mm. in size. A temperature of 1600°C. was required for coke with 8 to 10 per cent of ash without the addition of limestone or other fluxes. Under these conditions 40 tons of coke per day were gasified with a yield of 3½ million cu. ft. of gas with a C.V. of 270 to 290 B.Th.U. per cu. ft.

Oxygen was purchased at 2.3 pf. per cu. m. (say, 1s. 6¾d. per 1000 cu. ft.) An average oxygen consumption of 300 cu. ft. per 1000 cu. ft. of gas produced, as reported by the C.I.O.S. investigators, is approximately 50 per cent higher than the figure mentioned in previously published work.

TABLE III.

COMPARISON OF THE PERFORMANCE OF A FIXED-GRATE GENERATOR FOR WATER-GAS PRODUCTION USING "GRUDE COKE" WITH (*a*) THE USUAL "MAKE-AND BLOW" CYCLE USING AIR, AND (*b*) OXYGEN/STEAM BLAST.

	(*a*) "*Make and Blow*" *with Air*	(*b*) *Oxygen/ Steam Blast*
Analysis of Gas produced :—		
CO_2	5.0%	22.7%
CO	42.0%	34.7%
H_2	49.0%	40.3%
N_2	4.0%	2.3%
Assuming that all the gas produced is converted to hydrogen, the following are the requirements per 1,000 cu. ft. of hydrogen :—		
Hard coke (lbs.)	38.9	35.2
Oxygen (cu. ft.)	—	290.0
Steam to generator (lbs.) ...	48.4	66.0
Steam to conversion plant (lbs.)	37.7	65.7
Total steam required (lbs.) ...	86.1	131.7

(British equivalents given above have been calculated from the original German Data embodied in *CIOS File No.* XXXII—107, and *BIOS Final Report No.* 199.)

Dr. Rettenmaier, the chemist responsible for the development work, stated that cheaper oxygen could be produced by using coal screenings to generate high pressure steam for the turbo-blowers and compressors in the *Linde-Frankl* plants and utilising the exhaust low-pressure steam for gasification in the generators. In his opinion oxygen could be produced in this manner at 1 to 2 pf. per cu. m. (say, 8d. to 1s. 4d. per 1000 cu. ft.).

Table IV shows the results obtained using coke with 85 per cent fixed carbon and average particle size 40 to 60 mm., the figures being obtained in three typical operations, each of one day's duration.

It is to be noted that the figures for the percentage steam decomposition are very high, while those for coke consumption are surprisingly low, particularly as about one-sixth of the total gas make is burned at the tuyeres. While there is no apparent reason for doubting the accuracy of the figures quoted by the German operators, the coke consumption represents a very high level of efficiency. The team of investigators state[3] : " All of the available figures are presented without change. No attempt was made to check the claimed efficiencies and percentage of steam decomposition, nor have any calculations been made on the rate of gasification. The previously published data on the Thyssen-Galocsy process are not available for comparison with the results presented to this investigating group. It appears, however, that the gas composition is about as previously reported, but that the oxygen consumption—which is one of the major factors in the cost of production—is ap-

TABLE IV.

THYSSEN-GALOCSY SLAGGING GAS PRODUCER AT WANNE-EICKEL

Using coke with 85 per cent. fixed carbon and 40 to 60 mm. in size, the following results were obtained in a Thyssen-Galocsy slagging producer in three typical operations each of one day :—

	Test 1	2	3
Coke gasified (85% fixed carbon, 40 to 60 mm.)	46.6 tons	39.2 tons	41.3 tons
Steam used for gasification	25.8 tons	17.8 tons	18.9 tons
Coke gasified per hour per sq. ft. of hearth area	255 lb.	215 lb.	232 lb.
Oxygen supplied :—			
Purity	81%	90%	90%
Volume in cu. ft. ...	1,132,250	868,000	903,000
Auxiliary Gas (gas produced but burned at the tuyeres) in cu. ft.	571,550	562,450	603,750
Oxygas produced (total production *less* auxiliary gas) in cu. ft.	3,689,000	2,963,275	3,124,450
Analysis of Oxygas produced :—			
CO_2	4.6%	2.1%	2.1%
O_2	0.1%	0.1%	0.1%
CO	65.3%	70.4%	71.0%
H_2	24.6%	23.1%	23.3%
CH_4	0.2%	0.2%	0.2%
N_2	5.2%	3.4%	3.3%
Lower C.V. of Oxygas (B.Th.U. cu. ft.) ...	272	286	288
Steam decomposition (per cent.)	82.1	90.1	90.1
Percentage gasification :— (Total gas C.V.) (Total coke C.V.)	85.5	85.2	86.7
Requirements for each 1,000 cu. ft. of Oxygas produced :			
Pure Oxygen (cu. ft.)	300	290	290
Steam (in lbs.) ...	16	13	13
Coke (in lbs.) ...	27.6	29.0	29.0

(British equivalents given above have been calculated from the original German Data embodied in *CIOS File No.* XXIX—51.)

proximately 50 per cent higher than mentioned in any of the reviews."

[The second part of this article will appear in a subsequent issue.]

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[2] "Winkler generators for manufacture of water gas." *BIOS Final Report, No.* 333.
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[4] A.G. Sachsische Werke, Bohlen. *CIOS Item No.* 30, *File No.* XXX—13.
[5] Metallgesellschaft-Lurgi. Frankfurt am Main. *CIOS Item No.* 30, *File No.* XXXI—23.
[6] "Lurgi high-pressure gasification." *BIOS Final Report No.* 521.
[7] Danulat: Gas und Wasserfach." 1941. Vol. 84, p. 549. 1942. Vol. 85, p. 557.

Andersonian Chemical Society

Diamond Jubilee Celebrations

THE diamond jubilee of the Andersonian Chemical Society was celebrated in the Chemistry Department of the Royal Technical College, Glasgow, on November 22, when the large audience included members of other chemical societies, together with members of the public.

The honorary president, Professor W. M. Cumming, O.B.E., D.Sc., F.R.I.C., M.I.Chem.E., F.R.S.E., read various congratulatory letters and telegrams from other chemical societies and from various distinguished members of the Andersonian Chemical Society who were unable to be present.

Dr. D. S. Anderson, B.Sc., A.R.T.C., M.I.Chem.E., director of the Royal Technical College, referred to the excellent record of the Society throughout its 60 years of continuous existence. He pointed out that, although, as far as the College Chemistry Department was concerned, the past seven years was a period of "marking time," the future held great opportunity for teaching and research. Chemistry was "the Aladdin's Lamp of Science," and the world of the immediate future would prove to be a chemist's world rather than an engineer's world. The creation of new materials, which was the domain of the chemist, would be the major factor in the development of new industrial processes. It was to be hoped that many of the students would remain in Scotland to foster the establishment of genuinely new, and much needed industries.

The president of the Andersonian Chemical Society, Mr. J. B. Leitch, thanked Dr. Anderson for his opening remarks, and Professor Cumming called upon Professor J. W. Cook, D.Sc., Ph.D., F.R.I.C., F.R.S., Regius Professor of Chemistry at Glasgow University, to deliver the address in commemoration of the Society's jubilee.

Professor Cook expressed his appreciation of the honour conferred upon him and said that while the Andersonian Chemical Society was one of the oldest of chemical societies, it was possibly unique in having maintained a continuous existence for 60 years. He went on to give an interesting account of the history and development of the College from its foundation in 1796 under the will of John Anderson, M.A., F.R.S., Professor of Natural Philosophy in the University of Glasgow. This account was fully illustrated by an excellent series of lantern slides giving reproductions of portraits of former professors of the college and former honorary presidents of the Andersonian Chemical Society, together with views of the early college buildings. Among its professors were many distinguished in natural philosophy and chemistry, such as Thomas Garnett, M.D.; George Birkbeck, F.R.S.; Andrew Ure, F.R.S.; Carey Foster, F.R.S.; H. S. Herschel, F.R.S.; George Forbes, F.R.S.; Thomas Graham, F.R.S.; T. E. Thorpe, F.R.S.; Wm. Dittmar, F.R.S.; W. H. Perkin, F.R.S.; E. J. Mills, F.R.S.; G. G. Henderson, F.R.S.; and I. M. Heilbron, F.R.S. One of these, Professor Wm. Dittmar, F.R.S., was Professor of Chemistry when Anderson's College Science Society was brought into being in 1886 and he became its first honorary president, with Dr. Wm. Cullen as first secretary. A year later this society changed its name to The Andersonian Chemical Society. The original function of the society was set out as follows: To read papers on and discuss and debate on scientific subjects principally. Professor Cook described the state of knowledge in the various branches of chemistry at the time of founding of the Andersonian Chemical Society and the development of chemistry during the lifetime of the society. He suggested that it would be greatly to the advantage of the student members of the Society to take part in and encourage discussions and debates between themselves rather than listen to lectures by experts. In the present period of social revolution, it was desirable that powers of judgment and independent thought be encouraged by universities and technical colleges, which should seek to educate their students in the fullest sense and keep them informed on the widest

variety of topics. Professor Cook concluded by wishing the society a successful and vigorously active future in order that it might on some later date celebrate its centenary with an even greater pride.

Dr. William Cullen moved a vote of thanks to Professor Cook and recalled the days when he was first secretary of the society.

Professor Cumming emphasised the indebtedness of the society to Professor Cook, and as a gesture of goodwill he proposed that Professor Cook be elected an honorary vice-president of the society. Professor F. S. Spring, Ph.D., D.Sc., F.R.I.C., seconded this proposal and Professor Cumming terminated the proceedings by voicing the thanks of the society to the staff and students of the college for their efforts and to the industrial firms concerned for the loan of equipment for exhibition purposes.

During the afternoon a large number of visitors inspected the teaching and research laboratories in the School of Chemistry. The technical chemistry department was particularly popular and a keen interest was shown in the different types of chemical plant on view. These included a semi-technical distillation unit, film evaporator, filter press unit, drying oven, refrigeration unit, homogeniser, sugar refining plant, single tube evaporators, high-pressure autoclave, high-pressure circulatory system, gas compressor and holder, rotary vacuum filter, and a small producer unit (from the original Anderson's College). On view also were the workshop, with milling and drilling machines and heavy precision lathes, the fuels testing laboratory, a thermal diffusion unit, and a high-vacuum distillation unit. In the dyeing and colour chemistry department, much interest was aroused by an extensive collection of multi-coloured exhibits which included dyed wools, rayons, silks and cottons, while diagrammatic posters depicted the processes of manufacture of certain dyestuffs. On view also were many different forms of various plastics, while the ladies were particularly interested in samples of machine-printed fabrics, dyed hides, glass fibre cloth, coloured woollen fabrics and vegetable protein fibre cloth.

During the afternoon, tea was served. A highly successful dance on Saturday evening concluded the proceedings.

German Technical Reports

Some Recent Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

BIOS 629. Investigation of synthetic resins used in the German surface-coating industry (12s.).

BIOS 660. *Ruetgerswerke A.G., Rauxel*: Distillation of coke-oven tar (2s.).

BIOS 724. Electronic principles as applied in Germany to the testing of materials (16s. 6d.).

BIOS 732. *Luenburger Wachswerke A.G., Luenburg*: Waxes (2s.).

BIOS 736. Chemical laboratory instrumentation (3s.).

BIOS 739. *I.G. Ludwigshafen*: Maleic anhydride by oxidation of crotonaldehyde (6d.).

BIOS 742. *I.G. Farben, Ludwigshafen*: Preparation and polymerisation of vinyl ethers and preparation of acetaldehyde from methyl vinyl ether (1s.).

BIOS 744. *I.G. Hoechst*: Manufacture of vinyl acetate polymers and derivatives (1s. 6d.).

BIOS 745. *I.G. Hoechst*: Manufacture of monomeric vinyl acetate (1s.).

BIOS 746. *I.G. Ludwigshafen*: Vinyl carbazole and vinyl pyrollidone (6d.).

BIOS 747. *Ruhrchemie, Holton*: Acetylene by the arc, also the oxosynthesis (6d.).

BIOS 763. Identification of dyestuffs in I.G. (6d.).

BIOS 772. *Kalle and Co., Wiesbaden/Biebrich*: Manufacture of diazo chemicals (2s.).

BIOS 776. *I.G. Farben, Wolfen*: Manufacture of ethylene oxide, ethylene glycols, and ethylene chloride (4d. 6d.).

BIOS 839. Report on investigation of methods of gaseous metal treatment (2s.).

BIOS 851. *I.G. Hoechst*: Chlorinated methane derivatives (1s. 6d.).

BIOS 852. *I.G. Leverkusen*: Hydrofluoric acid (1s.).

BIOS 863. *I.G. Farben Fabrik, Wolfen*: Production of liquid sulphur dioxide (2s.).

BIOS 877. *I.G. Oppau*: Oxidation of hydrocarbons to ethylene and of methane to acetylene, with conversion of acetylene to acetone (1s.).

FIAT 699. Magnesium determinations in aluminium (6d.).

Designed to cover the firm's export activities, a booklet entitled *Service to industry by Whessoe during the period of reconstruction in Britain and overseas* is the latest publication by Whessoe, Ltd., 25 Victoria Street, London, S.W.1—a title impressively supported in the interesting range of photographs and explanatory text. Copies of the booklet are obtainable from the firm.

CONVERSION TO FUEL OIL

by F. J. ERROLL, M.A., A.M.I.E.E., M.P.

FUEL oil may be used industrially for central heating and general steam-raising boilers, for furnaces, and for ovens; and a broad distinction between the two grades of oil, pool fuel oil and heavy fuel oil, is that the latter is only suitable where preheating and pumping arrangements are adequate for handling this higher viscosity liquid, which means in practice the use of larger sizes of boilers and furnaces.

During the year ended April 1, 1943, only 110,000 tons were used for industrial steam-raising out of a total of 840,000 tons used for all industrial purposes in Great Britain. The main uses were in metallurgical furnaces where a total of 420,000 tons were consumed, and in industrial furnaces, other than metallurgical, a further 35,000 tons were used. The chief remaining uses were in the glass industry 120,000 tons, bakeries 50,000 tons, vitreous enamelling 14,000 tons, and bricks and pottery 4000 tons. Consumption in that year, 1943, represented less than 1 per cent of the coal used in this country.

The New Situation

That situation has persisted since the duty of £1 a ton was imposed in 1933 as a protection for Britain's coal and gas industries. In the ensuing period the relative consumption of fuel oil has not increased at the expense of other fuels, as it had been doing; on the other hand, it has not markedly declined either. Presumably the lifting of the duty will act as a lifting of the flood-gate, or at least of the lock-gate. To estimate what power has been dammed up behind the gate —or, in other words, to assess the new situation created by the remission of the duty on imported petroleum fuel oil—a number of factors need to be taken into account. These are:

1. The comparative availability of solid and liquid fuels (a) immediately, (b) over a period of years.
2. The cost of installing the necessary plant and equipment for oil firing.
3. The comparative operating costs of fuel oil and solid fuel or gas.
4. The technical and other operating advantages of the alternative fuels.

There is no known formula applicable in all instances; the answer must be a balance of these several factors.

On the issue of supplies, industry is already fully informed of the dangers of the present and prospective coal situation. The chances are that for a few years the output of the mines may fall so far short of the demand that firms may be unable to obtain sufficient coal for all their purposes. Seen in this light, a partial conversion to fuel oil is in the nature of an insurance policy. That sufficient supplies of fuel oil, on the other hand, shall be available during the next two winters has become the personal responsibility of the Minister, who is satisfied that an increased consumption of 3,000,000 tons is feasible from the supply point of view.

On a long-term outlook there is no real likelihood of supplies drying up in the foreseeable future. On the other hand, improvements in the refining of petroleum may leave a progressively smaller residue for use as fuel oil; and in fact it should be noted that the present market for the oil is not such that it is in need of large new outlets. On balance, there is no greater danger of a long-term deficit of fuel oil than of a prolonged shortage of coal, and it is unlikely that installations made in response to the present coal crisis will be starved by fuel within the next decade.

The cost of installation varies between wide extremes, depending naturally on the character and scale of the individual instance. It has been estimated that the cost of conversion for a works using about 10,000 tons of coal a year might range from £8000 for a simple steam-raising plant of six Lancashire boilers to as much as £30,000 for a more involved installation. In determining whether the installation is justified, a powerful factor is that it may save the factory from a shut-down due to fuel shortage.

Reasons for Conversion

One large Midlands firm decided to install auxiliary steam-raising plant for seven existing Lancashire boilers, to consume between 25,000 and 45,000 gallons of fuel oil a week. By interlinking the storage plant at their foundry and forging factory they were able to effect the installation for less than £5000. To justify installation at this cost there must either be marked technical advantages or a material possibility of sustaining increased productive activity. On the latter point, one firm in the chemical industry has determined to make the conversion partly because the shortage of coal has reduced the export value of a major product by £2,500,000 per annum. This firm is technically capable of burning 1,100,000 tons of fuel oil a year in place of 1,800,000 tons of coal if the necessary plant is installed.

Operating costs also vary according to the use. In the non-ferrous industries, for ex-

ample, the general experience in firing furnaces has been that fuel oil—even when carrying the duty—worked out at anything up to 25 per cent cheaper than solid fuel or gas, though this figure is based to some extent on such operating economies as the elimination of scrap. The removal of the duty has encouraged still further conversions in this industry, which on all grounds is one of the best suited to use fuel oil.

Comparison of Costs

For steam-raising purposes, probably the most important in the case of the chemical and allied industries, fuel oil has not hitherto shown a cost advantage over coal. With coal at 46s. a ton, and oil at 152s., the weekly operating costs of six shell boilers totalled £788 for mechanically-fired coal plant, £840 for hand-fired coal plant, and £1162 for oil plant. The repeal of the duty brings the oil figure down to £1028, while coal prices to-day are never below 50s., and more often reach 60s. At the latter figure mechanical firing would cost £958 a week, and hand firing £1020, so that on basic costs there is nothing much to choose. When, however, there is also taken into consideration the cost of coal handling and the lower operating costs for fuel oil, the latter is seen to have a clear-cut advantage on a cost basis alone. Even in cases where cheap coal inclines the balance in favour of the solid fuel, there are still boiler operators who prefer oil, maintaining that the extra cost is balanced by the ease of handling and stoking.

This leads to the final set of factors to be taken into account—technical and operating advantages. These may be summarised as ease and accuracy, convenience, and reliability. Fuel oil has a uniformity of composition which in these days of slatey and otherwise undependable coal is a far from negligible quality. The oil permits easy adjustment of furnace atmosphere and the application of thermostatic control. The highly radiative nature of the flame may be an advantage or a disadvantage, according to whether high, low or moderate temperatures are required.

Compared with coal, fuel oil is less trouble to store and handle: it occupies less space and demands less handling equipment. For another thing, it can often be used in confined spaces where coal handling plant cannot effectively penetrate. Delivery is by tank wagon and unloading is by pipe rather than by hand or complicated machinery.

Other sources of operating economy are: firstly, the thermal efficiency in use is increased by valve control and ease of adjustments of the atmosphere; secondly, the output of the plant can be increased because the plant is more rapidly heated from cold to working temperature, and because goods are more quickly heated by the high radiating power; and thirdly, lower fuel consumption is permitted, since when the furnace is not needed the fuel supply can be completely shut off.

It is true that in many of these respects fuel oil has no advantage over town gas. Indeed, under conditions in which ease of operation, use in a confined space, and convenience of adjustment are important, gas is the natural competitor. In general, however, gas is considerably more expensive.

In the light of these various factors must any proposal to convert to fuel oil be considered? If on balance it is accepted as wise in all the circumstances, the following brief account of the necessary installations may serve as an introduction to the subject. At the storage end, difficulties of supply are being experienced owing to the universal shortage of steel sheet and its heavy demands for other purposes. When steel tanks are available they are better welded than riveted; they are normally of a sufficient capacity to take 100 tons or more, or are of a subsidiary type capable of taking up to 40 tons. One method of meeting the supply situation is to use concrete tanks, which are likely to come increasingly into use. It is important, however, that there should be some facing material impervious to the oil, which will seek out possible leaks very quickly.

Storage Precautions

Storage plant may be sited almost anywhere, above, on, or below ground, in basement or on the floor of most factories. Around the tank, however, there should be installed a reasonably oil-tight catch-pit capable of holding a minimum of 80 per cent of the contents; this will serve as an insurance against valve fracturing. It is also advisable to fit a vent pipe to enable rapid filling without danger of undue pressure. In open situations frost should be guarded against by using cast steel for the main valves, by lagging, and by using wrought iron for bend joints and similar fittings.

Pumping systems are manufactured by a number of specialist firms, and a selection can be made from the direct-acting steam pressure pump, electric-drive pressure pumps and two-thrown pumps, and direct-acting transfer and forced lubrication pumps.

In using fuel oil two stages of pre-heating are necessary, the first at the main storage tank to raise the oil to a temperature sufficient to secure the flow to the pump, the second at the burners to permit atomisation. Oil is characterised by viscosity, which is the degree of its fluidity, and this varies according to the temperature. Setting point is the temperature at which the oil changes from fluid to solid state. Flash point is the temperature at which, on being slowly heated, it begins to evolve a vapour

which, with air, forms an explosive mixture. Firing point, finally, is the temperature at which an oil will yield a vapour which when ignited burns continuously.

The amount of pre-heating required varies according to the nature of particular installations, and among the factors to be considered are the grade of oil, arrangements of tanks and pipes, and the type of burner in use. The atomising burners are of three main types: pressure-jet burners, used mainly for steam boilers; steam jets, also used mostly for steam-raising; and air-jet burners for industrial furnaces. These also tend to be in short supply as the result of the sudden new demand, but the position may be eased by supplies from the U.S.A.

If a changeover is effected in stages, where more than one boiler is in use, the risk of a total shut-down is averted in the early stages, and staff can be accustomed slowly to the new routine. But expert advice, preferably by the boiler makers themselves, should be obtained before converting existing boiler plants. Advice should also be taken of the Regional Officers of the Petroleum Board who are acting as advisers to the Ministry of Fuel and Power in this connection. They will be able to advise on the local position with regard to the availability of oil supplies, and also on the new zonal pricing system, which ranges from 7¾d. to 10¼d. for pool fuel oil, and from 7¼d. to 9¾d. for heavy fuel oil, per gallon, as between areas around the main ports and inland areas.

When the Minister of Fuel was asked for an assurance that firms making a partial conversion will not have their allocations of other fuels cut by a corresponding amount, the reply was not entirely satisfactory. In effect, consumers who convert partially to oil have an assurance of full supplies of oil for the converted plant, together with their fair share of the available supplies of coal for their remaining production. Conversion cannot therefore be regarded as a gross gain in the satisfaction of total fuel requirements.

No assurance has been given as to how long the repeal of the duty will remain effective, although there are strong hints from the Ministry that no re-imposition is at all likely while fuel continues to be anything like the problem it is to-day. In the short run, therefore, fuel oil may be a valuable stop-gap; in the long run it has still to justify itself.

Fuel Efficiency

Summing Up of Recent Conference

THE November issue of *Fuel Efficiency News*, published by the Ministry of Fuel, contains reports by the chairmen of the various sections at the recent conference on "Fuel and the Future." Below are extracts from the report of Dr. E. V. Evans, chairman of the Carbonisation and Chemical Industries Section:

The industries for which I speak, the gas industry, the coke-oven industry, and the chemical industry, deal with about 50,000,000 tons of coal annually. In each of these industries voluntary organisations for conserving fuel have been established during the war years, and I am pleased to say there is a friendly and stimulating rivalry in fuel efficiency between the separate units of each industry.

In the carbonising industries the problem has been to make the best use of existing plant and it may be said that, despite the difficulties of the war period and the shortage of labour, the deterioration in the quality of coal and the difficulties associated with ageing plant, it has been possible to maintain high thermal efficiency. A fine piece of team work has been effected and, what is of importance to the Minister, this work will continue. The same, indeed, may be said of the chemical industry.

A fair proportion of the plant in existence was designed at a time when fuel economy was a less important issue than it is to-day. Coal was cheaper and considerations of capital cost limited the full employment of fuel saving devices. It is obvious that new plant will take a much greater account of these principles of design which lead to the utmost thermal economy. Each plant and each process presents a different problem in the balance of heat and power requirements and the solution of these problems of applied thermo-dynamics will be a primary feature in future plant design.

Many interesting references were made to indirect fuel savings. It was pointed out that in the case of gaseous firing a high degree of efficiency is possible because that fuel is capable of accurate control and furnaces may be designed to fit the work schedule. Again, the production of goods with a smaller proportion of rejects represents a real and substantial saving. The chemical industries have pointed out how the prevention or reduction of corrosion can produce a large, though not always immediately obvious, fuel saving.

All three industries represented in this section are facing a large programme of work in maintaining the efficiency of existing plant and of designing, erecting, and operating new plant.

Chemical Exports

Highest in Value Since the War

THE value of U.K. exports in October was £90.9 million. This is only £1 million less than the peak month of July, which had the same number of working days. The increase compared with September is £20.1 million, but this comparison is less satisfactory owing to the reduction caused by holidays in that month.

Exports of chemicals, drugs, dyes, and colours—which are grouped together in the Board of Trade returns—reached the highest value since the end of the war, the total figure being £6,545,179. This is an increase of £1,969,711 compared with September; an increase of £1,376,605 compared with October last year; and £4,688,530 compared with the monthly average for 1938. Chemical manufactures and products (other than drugs and dyestuffs) accounted for £3,401,662 of the total; drugs, medicines, and medicinal preparations for £1,663,348; and dyes and dyestuffs, and dyeing and tanning extracts, for £758,918. British India easily maintained her position as the leading buyer, her purchases reaching the record total of £1,292,963; Australia came second again, with a total of £395,844; and Germany, surprisingly, third with £247,083.

Imports of chemicals, drugs, dyes and colours were valued at £1,499,689, which is an increase of £518,016 compared with September; an increase of £588,374 compared with October last year; and £365,298 compared with the monthly average for 1938. The U.S.A. was the largest supplier, with goods valued at £368,923; the Argentine Republic was second (£246,466); and Spain third (£137,449).

Potassium Metal

Production by Thermic Reduction

THE FIAT Report No. 695, which is concerned with the manufacture of metallic potassium, is of importance to the British chemical industry as the German thermal reduction method had completely replaced the more usual electrolytic process in that country.

The original German process consisted of heating the mixture of potassium fluoride and powdered calcium carbide to about 1000-1100° C. in a retort. The metallic potassium vapour condensed and was stored under a petroleum oil. The basic reaction for this process is:

$$2KF + CaC_2 \rightarrow 2K + CaF_2 + 2C$$

and the yield is about 80 per cent using good quality raw materials.

Dr. Kolbe of the I.G. at Hochst further improved this method by replacing calcium carbide by elemental silicon according to the following reaction:

$$4CaO + Si + 4KF \rightarrow 4K + 2CaF_2 + 2\ CaO.SiO_2$$

The advantages of the second process over the first are obvious as far less silicon is required for the reduction of the potassium fluoride than calcium carbide, while the residues are more friable using the second reaction. It must be noted, however, that the calcium oxide must be completely dry or an explosion is liable to develop. One disadvantage of using silicon as a reducing agent is that while the initial reaction proceeds at a lower temperature the final temperature must be higher to ensure the completion of the reaction.

Full working details are given in the FIAT report of the German work to date on this subject and valuable translations are included of relevant German patents.

LINSEED OIL SUBSTITUTES

In view of the present shortage of linseed oil, it is satisfactory to note the progress made in the application of petroleum aromatic extracts to paint formulation, by which, it is claimed, it is possible to replace effectively up to 20 per cent linseed oil in all types of paint. A short booklet on the subject has just been issued by Petromar, Ltd., one of the associated companies of Manchester Oil Refinery, Ltd., Adelaide House, London Bridge, London, E.C.4, from whom copies are obtainable. As stated in THE CHEMICAL AGE on November 16 (*see* p. 604), the Paint Marketing Council has issued a statement pointing out that British paint manufacturers are in danger of losing their overseas markets unless the Government immediately increases supplies of raw materials.

NON-SILICA GLASS

The increasingly important part that new types of non-silica glass will play in optics, photography, enamels, etc., is commented upon in the October issue of *Ceramic Forum*. The new types of glass, which are made with the use of phosphates, borates or fluorides, resemble silicate types of glass in general principles of chemical construction, but differ from them and from one another in important chemical and physical properties. Non-silica glass has already proved its value in the photographic field. For general use in optical instruments, it is likely that glass intermediate between the older silica glass and the new non-silica glass will be especially valuable.

Alkali and Alkaline Earth Hydrides

A Survey of Their Manufacture and Uses

THE descaling of metals in an alkaline pickling bath, which does not require the use of electrical current, has recently opened a potential market for large quantities of alkali metal hydride. Developed in the United States during the war by the Electrochemicals Research Section of E.I. du Pont de Nemours, the process has proved especially advantageous in descaling operations at wire works, being suitable for such metals as nickel and copper as well as steel. For alloy steels it shows promise of displacing to some extent the usual process of metal pickling by acid, especially in the case of stainless steels, but is also suitable for treatment of ordinary carbon steels. One advantage is that a much shorter time of immersion in the tank is needed, and therefore the possibility of detrimentally pitting the metal by careless dipping is largely avoided. There is also a notable saving of metal normally lost by solution in the acid, which for steel may amount to between 2 and 3 per cent.

The metal is first dipped into a bath of fused caustic soda containing 2 to 5 per cent of sodium hydride. Here, as a primary step, the scale is reduced. It is then, in effect but not in fact, blasted from the underlying metal by the violent generation of steam which takes place when the metal is subsequently quenched in water. As a final treatment, almost instantaneous dipping in an acid bath brightens the surface of the metal.

Reaction with Hydrogen

This practical application of a stable solution of sodium hydride in fused caustic soda for reducing metallic oxides to the metal revives interest in the hydrides of the alkali metals, also those of the alkaline earth metals, which have long remained solicitous of greater attention. These products are white crystalline solids, "salt-like" in character; which by electrolytic investigations have shown that their hydrogen behaves as the negative element, and under appropriate conditions may be used for reducing certain metallic oxides to the metal. The alkaline earth metals readily combine with hydrogen on heating, but the absorption of hydrogen by the alkali metals is exceptionally slow, and cannot be brought to completion unless the hydride is removed almost as quickly as it is formed, or, alternatively, the hydrogen is allowed to react with the metal in finely divided or vaporised form. Nevertheless, by the aid of an electrochemical process employing sufficiently high pressure for the hydrogen, alkali hydrides can be obtained in commercial quantities and at a price which permits of them being used industrially. The formation of alkaline earth hydrides, also commercially possible, proceeds with greater facility at lower pressures.

Lithium reacts vigorously with hydrogen at 600-700°C., forming a vitreous solid which melts at 680°C. Lewis (*J. Amer. Chem. Soc.*, 1916, *38*, 774) showed that this product was capable of conducting electric current, which is now true of certain other hydrides in the fused state only. The remaining alkali hydrides are prepared in a manner similar to that of lithium. Sodium hydride is formed when metallic sodium is heated in a current of hydrogen at 400°C., the reaction being promoted and to some extent controlled by the presence of a small amount of calcium or its hydride. A slightly lower temperature is needed in the case of the corresponding potassium compound. These alkali hydrides readily react with water to form the hydroxide and liberate hydrogen. This reaction, assisted by the oxidising action of the atmospheric air, may cause ignition of the hydride when exposed to dampness. Alkali hydrides are also very strong reducing agents, deposition of carbon taking place when heated in a stream of carbon dioxide. They also exhibit the property of absorbing sulphur dioxide, with formation of the hydrosulphite of the metal.

Properties of Hydrides

When heated in an atmosphere of hydrogen the alkali hydrides sublime, giving a white mass which rather resembles wadding, but which on closer examination proves to be a mass of needle-like crystals. They all conduct electricity when in the fused state, but they do not stand excessive heating, which causes them to dissociate or partially decompose into the metal and hydrogen, the latter partly in the atomic state. Apart from this they exhibit some corrosive action upon apparatus at high temperature, unless in solution in a suitable medium, such as the fused hydroxide; the corrosive action of lithium hydride is very pronounced and a subliming film of this hydride will invariably destroy the structure of any glass surface upon which it condenses. Dissociation temperatures lie very close together, excepting for lithium and the alkaline earth metals, which really show no sharp dissociation point because the temperature of decomposition rises with the quantity of hydrogen evolved and the remaining hydride then forms a solid solution with the liberated metal.

Sodium hydride, as commercially produced, is a free-flowing powder, varying from white

to grey in colour; it decomposes reversibly above 150°C., but much more rapidly at temperatures above 400°C., yielding metallic sodium and hydrogen. Moissan (*Compt. rend.*, 1902, 134/71) prepared it by heating sodium in hydrogen at 360°C. Ger. Pat. 490,077 (Deutsche Gold- u. Silber-Scheideanstlat v. Roessler, 1927) describes a process in which sodium in a finely divided state is treated with hydrogen at raised temperature, preferably in presence of a diluent which may be either an alkali chloride or carbonate, or sodium hydride previously made in small amount, the equipment being a heated rotary tube. U.S. Pat. 1,796,265 (Freudenberg and Kloepfer, assigned to Deutsche Gold- u. Silber- Sch. v. Roessler, 1931) specifies a temperature of 180-300°C.

Villard (*Compt. rend.*, 1931, 193/681) found that caustic soda and manganese could be heated in a current of hydrogen at 600°C. to produce metallic sodium, and at the same time sodium hydride was volatilised to form a deposit in a cooler part of the tube; the reaction proceeded rapidly at 700°C.

U.S. Pat. 1,958,012 (Muckenfuss, assigned to E. I. du Pont de Nemours, 1934) describes a process of manufacture in which the finely divided alkali metal is heated in an inert organic liquid distributing agent such as tetralin or "Nujol" oil for several hours in the presence of hydrogen, preferably at a temperature of about 250°C. and under a pressure of 500 lb. per sq. inch; it is said that alkali hydrides of high purity are obtained. Brit. Pat. 405,017 (Roessler and Hasslacher Chemical Co., 1934) refers to the action of hydrogen upon molten alkali metal which is distributed in finely divided state in an inert liquid hydrocarbon oil such as tetralin, commercial paraffin oil, or commercial lubricating oil, preferably at 230-400°C. and under increased pressure.

By a distinctly different process, Russ. Pat. 43,634 (Palkin, 1935) treats molten sodamide with hydrogen at a temperature not exceeding 200°C., subsequently extracting the sodium hydride from unchanged sodamide by the aid of liquid ammonia.

Few War Patents

As regards the period of the war, only one process for the manufacture of alkali metal hydrides appears in the patent literature. U.S. Pat. 2,313,028 (Siegmann, vested in Alien Property Custodian, 1942) vaporises metallic sodium in an electric arc which is struck between fused alkali metal electrodes in the presence of hydrogen maintained at a temperature of about 300°C. This process also appears as the subject matter of Ger. Pat. 730,329 (Siegmann, to Deutsche Gold- u. Silber- Sch. v. Roessler, 1942).

For the synthesis of organic compounds, sodium hydride has certain advantages as a Claisen condensation agent, either for ester and ester (e.g., ethyl acetoacetate, diethyl ethyl malonate, etc.), ketone and ester, or certain aldehydes and ester. It does not reduce unsaturation in the reacting material; secondly, it increases the speed of the reaction; and further, it actually drives the reaction to completion without the need for a tedious azeotropic distillation. According to E. I. du Pont de Nemours, it can be used in place of alkoxides to prepare any ester of acetoacetic acid and higher homologues of the common acetoacetic ester with up to 18 carbon atoms in the acid ester structure. Moreover, since the hydride does not reduce carbonyl compounds, these Claisen condensations can be carried out at higher temperatures, within the range 100-130°C., thus avoiding reduction reactions which otherwise would predominate at such temperatures if metallic sodium was used.

Use as Catalysts

Sodium hydride forms monosodium derivatives with such compounds as malonic acid and acetoacetic esters. In use for the production of alcohol-free derivatives of the unsaturated alcohols and hydrocarbons of the acetylene series, there is no simultaneous partial reduction of unsaturation. Ger. Pat. 709,227 (Hamsley, assigned to E. I. du Pont de Nemours, 1941) concerns condensation promoters in organic syntheses. Hydrides of either alkali or alkaline earth metals can be used as a catalyst, linking saturated carboxylic esters with like products, with aliphatic, aromatic, or hydroaromatic ketones, or with aromatic aldehydes, all these reactions being essentially Claisen condensations. Either the ester or the ketone has an aliphatic carbon atom with at least one hydrogen atom adjacent to the carbonyl group.

There is also another use for sodium hydride, which is rather notable. It can be used as a catalyst for the partial hydrogenation of polynuclear aromatic hydrocarbons, such as naphthalene, anthracene, fluorene, etc., even when these hydrocarbons are contaminated with sulphur. The hydrogenation of naphthalene to tetralin, using sodium hydride catalysts, has been studied by Hugel and Friess (*Bull. Soc. Chim.*, 1931, 49/1042); in these hydrogenations where sodium forms an intermediate compound with the organic structure, the lower limit of hydrogen pressure at which the reaction proceeds is stated to be about 15 kg. per sq. cm. (say, 200-220 lb. per sq. in.), and the optimum temperature is 270-320°C. Hugel and Gidaly (*Bull. Soc. Chim.*, 1932, 51/639) point out that the activity of sodium hydride in catalysing the hydrogenation of organic compounds is restricted to those parts of the molecule with which

sodium itself is capable of combining. Styrene is converted to diphenyl ethane; naphthalene to tetrahydronaphthalene; benzal fluorene to fluorene plus methyl fluorene; anisal fluorene to methyl fluorene; diphenyl butadiene to diphenyl butane.

U.S. Pat. 1,838,234 (Schirmacher and van Zutphen, assigned to I. G. Farbenindustrie, 1931) specifies the use of sodium hydride in promoting polymerisation of hydrocarbons of the butadiene series. In another direction it may conveniently be used for the linking of active methylene compounds with acrylonitrile.

Calcium Hydride

Calcium hydride is produced by the action of hydrogen on fused calcium metal, alternatively calcium chloride, at 550°C. and upwards, also by heating calcium in hydrogen at 150-300°C.; when calcium chloride is used, gaseous hydrogen chloride is a by-product of the reaction. Unlike the corresponding lithium compound, calcium hydride does not readily conduct electricity; it is stable up to 600°C., depending on circumstances, but loses its hydrogen at higher temperature. Under the name "hydrolith," it has been employed as a convenient source of relatively pure hydrogen; 1 kg. of the impure hydride, when treated with water, gives 1 cu. m. of gas. Like the hydrides of the alkali metals, those of the alkaline earths are also strong reducing agents. Methane of considerable purity is obtained by passing a stream of carbon monoxide or carbon dioxide over hot calcium hydride.

In the manufacture of calcium hydride according to U.S. Pat. 2,082,134 (Alexander, 1937), lime and powdered magnesium metal are placed in close association in a container which is filled with hydrogen, the temperature being then raised to above the melting point of the magnesium. The supply of hydrogen is maintained until all the magnesium is converted to oxide, with formation of the equivalent amount of calcium hydride. Fr. Pat. 819,533 (Ventures, Ltd., 1937) speaks of heating a mixture of lime and metallic magnesium in presence of hydrogen to a temperature above the melting point of the magnesium, a supply of hydrogen being maintained until the magnesium is wholly converted to oxide and calcium hydride is formed. In Brit. Pat. 485,163 (Ventures Ltd., 1938) it is stated that the temperature is maintained below 1100°C.

In organic synthesis, calcium hydride may be usefully employed in promoting the aldol condensations; apart from acetone, methyl ketones generally react, but not other ketones such as diethyl ketone (*Chem. Soc., Ann. Rep.*, 1925/73). In this way acetone can be converted to diacetone alcohol. Subsequently refluxed with iodine, diacetone alcohol is dehydrated to give mesityl oxide, which provides a starting point for methyl isobutyl ketone and other products, also finding use as a solvent for vinyl resins and ethyl cellulose, and in making lacquers and enamels. It would be more widely employed as a solvent and as a paint stripping agent, but for its odour suggestive of a mixture of mice and peppermint.

Calcium hydride has recently found useful application for the reduction of oxides of metals of high melting point. Investigations are reported in *J. Applied Chem.* (U.S.S.R.), 1940, 13/1770. The experiments were made with titanium dioxide, vanadium trioxide, columbium pentoxide, and tantalum pentoxide, using an electric furnace and hydrogen at atmospheric pressure. In the first three cases, employing 50 per cent excess of calmium hydride (80-90 per cent purity) and a duration of heating from 45 to 60 minutes, the most favourable temperatures were 950-1075°C., 1025-1175°C., and 950-1075°C. respectively. For tantalum pentoxide, the calcium hydride was made by heating a mixture of lime and magnesium to incandescence in hydrogen; here reduction was effected by heating for 60 minutes at a temperature of 1025-1100° C. Hydrogenated metals were produced under the most favourable conditions, the amount of hydrogen combined with the metal in the case of titanium being about 3 per cent; for vanadium, 1.2 to 2 per cent; columbium, 1 to 1.4 per cent; and tantalum, 0.5 to 1.2 per cent. The products were fine crystalline powders, of which the major portion exhibited a grain size up to 0.001 mm.

Hydrides and Water

Regarding the reaction between calcium hydride and water, Flood (*Kgl. Norske Videnskab. Selskabs Forh.*, 1935, 7/66) found that an excess of hydride and temperatures above 350° C. causes the reaction to proceed in the direction $CaH_2+H_2O \rightarrow CaO+2H_2$, whereas thermodynamic calculations indicate a metastable condition at ordinary temperature which follows the direction $CaH_2+2H_2O \rightarrow Ca(OH)_2+2H_2$. The action of calcium hydride upon media containing heavy water has been studied by Hughes, Ingold, and Wilson (*J. Chem. Soc.*, 1924/493). When part of the hydrogen is removed from calcium hydride, a single phase of solid is formed which is poorer in hydrogen. As decomposition proceeds, this phase is resolved into one product which contains more hydrogen and in composition closely approaches CaH_2, and another product containing less hydrogen which is nevertheless retained more firmly than in the case of CaH_2. With some degree of certainty it is, therefore, now generally recognised that the hydrides exist in two forms, especially those of the alkaline earth metals.

Palestine Chemical Notes

Reorganisation Needed after the Boom Period

(From Our Own Correspondent)

IN common with Palestine's other industries, the chemical industry is at the moment in the process of readjusting itself to post-war conditions. The boom period has passed, and reorganisation is necessary. Added to difficulties of importing the necessary raw materials and the high wage levels, the present boycott of Palestinian products by the States of the Arab League is also having its effects on the industry.

The great demands of the Allied Forces during the war, coupled with the needs of the civilian populations in the Middle East countries as a result of the complete stoppage of foreign imports, resulted in the Palestine chemical industry finding its feet. Palestine manufactures a wide range of inorganic chemicals, fertilisers, varnishes, paints, pigments, glues, gelatine, as well as a number of organic chemicals, pharmaceuticals, photo-chemicals, edible oils, soaps, and tanning extracts, and local industries have taken advantage of the wide range of chemicals so easily available. At one time the Palestine chemical industry employed about 5000 workers.

Supply of Raw Materials

Local manufacturers have to study carefully from the business point of view the supply of raw materials in Palestine, where kaolin and other clays, iodine, manganese ores, gypsum, phosphates, and other materials are available. From vegetable and animal sources a number of raw materials are obtainable, some of which have been successfully used in local factories. Among these are carob beans, cane sugar, dates, citrus, medicinal plants, herbs, bones, hide, and wool.

The supply of pyrites from Cyprus may become an important factor in the Palestine industry. The Mediterranean island is also known to have magnesite, chalk, gypsum, and chromites in considerable quantities. The prohibition by neighbouring Arab countries of the export goods to Palestine affects various raw materials. Egypt, for instance, will not allow the export of bones for the Palestine glue industry. It is generally acknowledged that prices of Palestine manufactured chemicals are high and the first British peace-time offers created the impression that local competition would be difficult if not impossible. In the course of time, however, it was found that many British products could be delivered in only limited quantities.

The Palestine industry is aware that there is a great shortage of chemicals on the Continent and it is felt that the country might be able to assist in meeting this demand, provided the Palestinian prices and qualities are satisfactory. But the readjustment of prices is not an easy task. Wages are still at a high level, owing to the great cost of living, so that the proportion of labour costs amounts to 35 per cent of the total cost of production. This includes workmen's compensation, health insurance, paid leave and gratuities to workers. In addition, a considerable amount has to be spent on the modernisation of the present equipment, but in this respect the situation appears to be improving.

There is some speculation as to the possibilities of the Palestine chemical industry supplying part of the former German exports to the Middle East. Such a development would not interfere with British exports, but here again the political situation is proving an obstructive factor. As a result of the Arab boycott, the chemical industry is compelled to concentrate more and more on the local market, but since this is relatively small—Palestine's total Arab-Jewish population is under two million—efforts have to be made to find other markets. Contacts have already been established with North and East Africa, Greece, Turkey, and some European countries. Various transactions are at present being negotiated.

Plans For Future

Generally, although the end of profitable war contracts almost coincided with the Arab boycott, causing a most difficult transition period, most of the Palestine chemical manufacturers have been able to overcome the temporary difficulties, and are planning to continue production on the broadest possible lines.

To extend the scope of activities of the Palestine chemical industries, a new organisation, to be known as the General Society for Chemical Production in Palestine, Ltd., has been founded with a registered capital of £P100,000.

The new organisation is to erect a factory in Emek Zebulun on about 20 acres of land, and will produce sulphuric acid, phosphorus fertilisers, various kinds of aluminium products, copper sulphate, and magnesium sulphate. It is expected that the output of sulphuric acid will reach close on 15,000 tons per annum, of which two-thirds will be used in the manufacture of artificial fertilisers.

Czech National Enterprises

Synthetic Fuel from Stalin Works

REPORTS of recent developments in the Czechoslovak chemical industry indicate that ten national enterprises have been formed out of about 80 establishments which were formerly independent concerns. Six of the new enterprises have been set up in the two western provinces of Bohemia and Moravia, and four others in Slovakia. The industry employs at present about 40,000 persons and the annual value of its products aggregates about 8 milliard Czech crowns. It has been possible to increase output from about 30 per cent in 1945, to 70 to 80 per cent of capacity. At the same time a reserve of raw materials sufficient for several months, with the exception of common salt and petroleum residues, has been accumulated.

The nationalised chemical industry is said to be working at a profit and the financial results of the current year make allowances not merely for the normal depreciation of plant, but also for the assignment of considerable sums for the use of the works councils to cover social needs of the staff. The surplus finds its way into the Treasury.

As far as exports of chemical products are concerned, those in charge of the industry's affairs aim to send sufficient chemicals abroad to be able to pay for foreign raw materials. During the first half of the current year, exports of the nationalised chemical industry totalled about 150,000,000 Czech crowns. However, reference must be made to the fact that a large proportion of the output is indirectly exported, *i.e.*, after having been used by the glass, machinery, and foundry industries. Czechoslovakia's main customers have been Switzerland, Yugoslavia, Sweden, Holland, Denmark, and Austria.

Oil from Lignite

Details have been made known about the production of synthetic oil from lignite at the Stalin Works—formerly known as Hermann Göring Werke. This plant, near the town of Brüx, in North-West Bohemia, was built by the Germans, during the occupation of Czechoslovakia, at an estimated cost of 7.5 milliard Czech crowns. The intake of lignite amounted to 10,000,000 tons a year and during the occupation about 42,000 persons from all parts of Europe were employed in this giant plant, which had an important function in Germany's oil economy. Small wonder, then, that it formed an important target for the Allied air forces, which dropped nearly 14,000 bombs and more than 200 parachute mines on it, causing considerable damage.

At the end of the war, the works were considered as war booty by the Russian Government, which, however, decided to transfer it to the Czechoslovak authorities without compensation. The latter put in hand the necessary reconstruction work and plans have been made for a reorganisation of the whole plant. New dwellings for the staff and social amenities are being provided by the Czechoslovak Government.

Wide Range of Products

The Stalin Works are now producing a wide range of products, including, for instance, motor fuel, aircraft fuel, paraffin oil for tractors, and other machinery, Diesel oil, gas for use in vehicles equipped with generators, and gas for domestic and lighting purposes. Among the more specialised products are ligroin, petroleum, ether, solvents, and lubricants, while the gaseous products include propane, butane, ethane, methane, hydrogen, oxygen, and nitrogen. Basic products for the organic chemical industry, materials for use in the textile industry, softeners for the paint and rubber industry, and other products also form part of the works' manufacturing programme.

There can be no doubt that the Stalin Works occupy an important position in Czechoslovakia's national economy, and their importance will be further enhanced by the Government's ambitious fuel production programme under the new Two-Year Plan. Under this plan, the lignite deposits, which form the raw material for the Stalin Works, are to be exploited to the extent of about 23,000,000 tons. Of this, 20-25 per cent will be waste and coal dust, which are to be utilised for the manufacture of synthetic fuels and basic chemical products.

No figures have been made available as yet as to the price of the synthetic fuel, but recent increases in the price of lignite have been reflected in the price of the various products manufactured in the works. The prices are, on the whole, higher than those ruling in the world market, but it is hoped that improved production methods and the general reorganisation of the manufacturing programme will bring the price of the finished products more into line with world prices. However, it appears that in view of the centralised planned economy of the new Czechoslovak Republic, the question of prices will hardly be a decisive one. Moreover, supplies of oil from UNRRA will stop at the end of this year, and because the country has no large resources of foreign exchange to pay for the import of oil from abroad, the manufacture of synthetic fuels will receive a powerful impetus.

A CHEMIST'S BOOKSHELF

The Story of Plastics. By H. R. Fleck, M.Sc., F.R.I.C. London: The Burke Publishing Co., Ltd. Pp. 96. 7s. 6d. net.

This book, which is the first in a "Commodity Series," is not a technical treatise for the scientist, but a fascinating account for the man in the street of the growth of a great modern industry. It is written in a clear, understandable manner, and the many charts, diagrams, and illustrations, which form a main feature of the book, are well selected, thus giving a vivid pictorial survey of the manufacture and wide use of plastics. The first part of the book deals with the birth and constitution of the industry, and the next gives basic facts of the science of plastics. The author also discusses the chemistry of plastics and the moulding as well as the application and wide uses of plastic materials. He examines the opportunities that exist for administrative and technical knowledge, as well as the special qualifications required for the many executive positions. The author, who, during the war, was technical adviser on non-metallic materials and plastics to the Ministry of Aircraft Production, presents a book for everyone who would like to know the truth about these magic materials of our modern world.

Vat Dyestuffs and Vat Dyeing. By M. R. Fox. London: Chapman & Hall, Ltd. Pp. 319. Price 24s.

Mr. Fox has brought together a good deal of useful information about vat dyestuffs and their application, and the resulting book is one which will prove to be a very handy reference volume for all those whose work is connected with these products and their application and testing in industry. The specialist may not find that it deals with his own particular section in a manner sufficiently deep to satisfy him; on the other hand, those whose work is confined to the application of these dyestuffs will obtain a good general account of the chemical constitution and properties of the dyestuffs they are handling, while those whose interests are solely on the manufacturing side will find much useful information in the chapters dealing with the application of these colours in industry.

The volume leaves something to be desired when considered as a text-book, as the scientific aspects are rather sketchily dealt with. The section dealing with light tendering might well have been expanded considerably, and more could have been said of the effect of the physical properties of the dyestuffs in relation to yield of colour and shade when applied in various ways. Mention is made of the use of various auxiliary agents as levellers and dispersing agents in dyeing, but nothing is said of the selective action of many of these products and no indication is given of the precipitation of the leuco derivatives of certain vat dyestuffs when used along with specific auxiliary agents. A standard method of expressing weights and measures should have been maintained throughout. Many recipes given are expressed in English standards, while others are expressed as parts per thousand with no indication as to whether parts by "weight" or by "volume" are meant, and finally some amounts are expressed as percentages.

The book falls into three main sections, Chapters 1 to 4 dealing with the history, chemistry, and properties of vat dyestuffs; Chapters 5 to 11 with the application of these colours, including a chapter on machinery; and finally, a section dealing with the identification of vat dyestuffs, with a fairly comprehensive list of analogous dyestuffs from various makers.

References to sources of information from other books and journals are given, and as stated above one of the most useful features of Mr. Fox's work is that he has made available in a handy form information from many scattered sources. The book is clearly printed and well produced, and will be a useful addition to the library of textile and colour technicians.

R. J. HANNAY.

Indian manufacture of mica, hitherto mainly exported as a raw material, is likely to develop as a result of a recent conference between the Interim Government and representatives of the mica industry. "We should take steps to utilise our raw materials ourselves," said the Member for Works, Mines and Power, advocating co-ordinated and systematic development of the mineral. Negotiations with the United States for the reduction of her tariff rates on Indian manufactured mica were also urged.

Entitled the "ABC of High Frequency Heating of Metals," a well-produced quarto brochure of 20 pages, effectively illustrated by line drawings, has been published by the electronic heating department of Philips Lamps, Ltd., Aboyne Works, Aboyne Road, S.W.17, from whom copies may be obtained. The purpose of the brochure is to explain the elementary principles and applications of the high frequency induction heating process from the practical point of view of works executives, managers and others.

PARLIAMENTARY TOPICS

" Call Up " of Technical Students

IN the House of Commons last week, Mr. Hicks asked why students at technical colleges taking a university degree course had been excluded from the Government's undertaking not to " call up " university students until after they had completed their course.

Replying, Mr. Isaacs assumed the students referred to were those who had started their courses under the age for " call up " and had been granted temporary deferment until the end of the following July in order to take certain examinations. No undertaking had ever been given that such students, whether at a university or a technical college, would not be " called up " until they had completed their course.

Lt.-Commander Gurney Braithwaite hoped that, in framing the new bill for compulsory service, the Government would bear this point in mind because, he said : " it is of the highest importance to our export drive that these young men should complete their education."

Mr. Walkden pointed out that some of our most successful " back-room boys " during the war were recruited from technical colleges and that many students were seeking a university degree. Could not the Minister grant the same facilities for external students as to full-time university degree students?

The Minister invited further information on the subject, but maintained that, taken by and large, the same treatment was given to technical as to university students.

Factory Developments

The total number of new factory buildings and extensions to existing factories (5000 sq. ft. and over) approved up to September 30, 1946, was 2236, to provide additional employment for approximately 340,000. This was stated by Mr. Belcher, for the President of the Board of Trade, in answer to Mr. Chetwynd.

Of these schemes, he further stated, 901 were in the development areas and should eventually provide employment for 201,000. Forty schemes had been completed in the development areas and should provide additional employment for some 5400.

Dismantling of German Factories

In the British zone of Germany, stated the Chancellor of the Duchy of Lancaster, Mr. J. Hynd, in reply to Mr. Molson, seven factories are in process of being dismantled; 35 more are scheduled for dismantling; and 398 others declared available for reparations but not yet allocated.

Mr. Hynd was also questioned by Mr. Birch and Mr. Molson regarding proposed dismantling and export as reparations at the factory of Mathes and Weber, Duisberg, producing soda for the manufacture of soap.

" The German chemical industry," Mr. Hynd replied, " is to be restricted under the present level of industry plan and this factory, which has been declared available for reparations, is on the list of those eventually to be dismantled and removed. It is, however, at present being maintained in production in view of difficulty in fully utilising other soda manufacturing plant in Germany."

Supplies of Lead

The total quantities of lead available in the last four quarters were given by the Minister of Supply this week, in answer to Mr. Byers, as follow :

			tons
1945			
Fourth quarter	...	...	81,189
1946			
First quarter	...	...	80,711
Second quarter	...	...	76,275
Third quarter	...	...	78,875

London Metal Exchange

Sir W. Wakefield asked the Minister of Supply when he proposed to free the metal market, to which the reply was that no decision had yet been taken about the re-opening of the London Metal Exchange.

Oil Plant, Dowlais

The Minister of Fuel and Power was asked by Mr. S. O. Davies if he would now reconsider his decision of three months ago to cease production at the oil plant, Dowlais, which rendered 180 men unemployed having regard to the fact that his reason no longer held good because no step had been taken to use the plant or any part of it for the purpose which he alleged necessitated its closing down.

Mr. Shinwell replied that the Minister of Food could not reconsider his decision to close this factory, which was originally taken on grounds quite unconnected with the supply of gas. The water-gas plants in the factory were still required in connection with the scheme for the supply of gas for local industry. He regretted the delay in beginning the work of adaptation. Three months ago the gas company was offered a loan under the Distribution of Industry Act covering the cost of the work and pressure was being put upon them to start the work without further delay.

The Royal Society

Awards of Medals

DISTINGUISHED chemists are among the latest recipients of medals awarded by the Royal Society.

SIR ALFRED EGERTON, M.A., B.Sc., F.R.I.C., F.R.S., who is Professor of Chemical Technology at the Imperial College of Science, secretary of the Royal Society and a past vice-president of the Institution of Chemical Engineers, receives the Rumford Medal for his leading part in

Sir Alfred Egerton

the application of modern physical chemistry to many technological problems. The Davy Medal has been awarded to PROFESSOR C. K. INGOLD, D.Sc., F.R.I.C., F.R.S., Professor of Chemistry at the University of London, for his distinguished work in applying physical methods to problems in organic chemistry.

The King has approved the award of the two Royal Medals for the current year to SIR LAWRENCE BRAGG, O.B.E., F.R.S., for his distinguished researches in the sciences of X-ray structure analysis and X-ray spectroscopy; and DR. C. D. DARLINGTON, F.R.S., for his distinguished researches in cytology and genetics.

Other medals awarded by the Society are: the Copley Medal to PROFESSOR E. D. ADRIAN, O.M., F.R.S.; the Darwin Medal to SIR D'ARCY THOMPSON, C.B., F.R.S.; and the Hughes Medal to PROFESSOR J. T. RANDALL, D.Sc., F.Inst.P., F.R.S.

A new high-speed spot and switch welding machine for the production and assembly of light steel articles has been introduced by Philips Industrial (Philips Lamps, Ltd.). This has a capacity of 23 kVA giving welds up to ¼ in. added plate thickness. Speeds of up to 120 spot-welds per minute are obtainable on material of 18 s.w.g. thickness.

Personal Notes

SIR ALEXANDER FLEMING has been awarded the honorary gold medal of the Royal College of Surgeons in appreciation of his distinguished work and particularly in recognition of the part he played in the discovery of penicillin.

MR. NORMAN NEVILLE, O.B.E., director of the British Chemical Plant Manufacturers' Association and the Food Machinery Industrial and Export Group, is representing the British Engineers' Association at the congress of the Federation of Polish Engineers at Katowice, Poland, on December 1-3, when the economic reconstruction of Poland will be the subject of a series of papers.

Obituary

DR. DOROTHY JORDAN-LLOYD, M.A., D.Sc., F.R.I.C., director of the British Leather Manufacturers' Research Association, died suddenly at Great Bookham, Surrey, on November 21, at the age of 57.

The daughter of Professor Jordan-Lloyd,

Dr. Dorothy Jordan-Lloyd

of Birmingham University, she went to Newnham College, Cambridge, and was elected a Fellow in 1914. After doing biochemical research at Cambridge, she joined the staff of the British Leather Manufacturers' Research Association and was appointed director in 1927.

Among her researches was the study of the colloid chemistry of simple proteins, and, during the 1914 war, culture-media for bacteriological work. Her book on protein chemistry is a standard work.

When Dr. Jordan-Lloyd took charge of the Leather Research Association great strides were made in evaluating such factors as the tensile strength of leather, resistance to abrasion, flexibility, etc.

She was a past vice-president of the Royal Institute of Chemistry.

Home News Items

Plans for new penicillin factories are under consideration, according to Mr. A. L. Bacharach, of Glaxo Laboratories, Ltd.

A 17-years old employee died of burns following an explosion in the mixing department of High Speed Alloys, Ltd., Widnes, on November 16.

An Italian trade delegation is shortly leaving for London to negotiate an agreement with Britain, the Italian Foreign Minister has announced.

The sales department and counting house of Howard-Taylor, Ltd., 89, Kingsway, London, W.C.2, have been transferred to 94, Balham High Road, London, S.W.12.

At a chrysanthemum show at Rhos, North Wales, employees of Monsanto Chemicals, Ltd., won seven challenge cups out of nine, as well as gaining ten first, seven second and four third prizes.

Twenty firms have promised to exhibit at the exhibition of work done in Widnes, to be held on April 11 and 12 under the auspices of the Scientific Section of Widnes Society of Arts.

The Standards Department of the Board of Trade has been transferred from Boots Hotel, North Promenade, Blackpool, to Chapter Street House, Chapter Street, London, S.W.1. (Tel. VICtoria 7032).

A two weeks' course for women industrial welfare officers will be held at the National Recreation Centre of the Central Council of Physical Recreation, Bisham Abbey, Berks, from January 11 to January 25, 1947.

A lavishly illustrated brochure, entitled "A Record of War and Peace," has been issued by Siebe, Gorman & Co., Ltd., Neptune Works, Davis Road, Tolworth, Surrey, whose artificial breathing apparatus of all types is well known.

The Irish Alcohol Company has started its biggest production campaign since before the war. Its four factories are now working three eight-hour shifts six days a week. Potatoes, beet and Cuban molasses are being used simultaneously as raw material in the Cooley, Carrickmacross and Labbadis factories.

The Ministry of Agriculture and the Department of Agriculture for Scotland are now prepared to receive from manufacturers applications for the official approval of proprietary formaldehyde, metaldehyde, pyrethrum insecticides, derris-pyrethrum insecticides and tar-petroleum oil winter washes. Application forms may be obtained from the Secretary of the Advisory Committee, Plant Pathology Laboratory, Milton Road, Harpenden, Herts.

Speaking at a luncheon of the American Chamber of Commerce in London, last week, Dr. W. H. Coates, deputy chairman of I.C.I., said the U.S., which dominated the economic position of the world, could make the greatest contribution to peace by maintaining its own full prosperity and employment, by opening up its barriers to trade and by acting as a full creditor nation. "The new Congress," he said, "will, I fear, be apt to rely only on private enterprise and reject any Government co-ordination."

Fuel shortage caused principal Sheffield steel manufacturers to close departments for two or three days last week. Future economy in the use of coal, however, is likely as a result of the use of fuel-oil for steel making. Four 80-ton steel furnaces have already been adapted for this purpose by the United Steel Companies, estimated to save more than 50,000 tons of coal annually; and two storage tanks are being built at their Stocksbridge and Templeborough works, with a combined storage capacity of 1600 tons.

Overseas News Items

Final plans have been approved in India for the establishment of a Fuel Research Institute and a National Metallurgical Laboratory. A location has also been agreed for a National Chemical Laboratory.

The recent soap shortage in the U.S.A. has spurred the manufacture of synthetic detergents. It is reported that manufacturers plan to expand production to three times the 1945 level of 125,00,000 lb.

The rise in Canada's imports of chemicals and products is shown by the following comparative totals (in million dollars): January-December, 1939, 43.7; January-July, 1945, 46.4; January-July, 1946, 54.5.

The Canadian Rubber Control Board has reduced the price of crude rubber to Canadian manufacturers from 24.91 cents per lb. to 22.63 cents. According to Government sources, the reduction was made possible by the fact that the U.S. Government recently purchased 200,000 tons of crude rubber.

The Chosen Chemical Fertiliser Company has opened at Inchon, Korea, a sulphuric acid plant, the only one of its kind in the country. Production amounts to between four and five tons daily. The product is of 93 to 98 per cent purity and is used as dehydrating agent in the manufacture of chlorine.

American scientists working at the University of California have weighed the meson, the atomic particle produced in cosmic radiation. They found it has one-fifth the mass of the proton, the positive particle of the nucleus.

The production of coal-tar chemicals consumed by the plastics industry in the United States has made gradual progress towards a restoration of normal supplies, according to the U.S. Department of Commerce.

October exports of rubber from Malaya showed a big increase over the previous month, the total being 73,383 tons, against 57,579 tons. Shipments to U.S.A. ports totalled 33,471 tons, while those to the U.K. were 30,463 tons, and Australia took 2288 tons.

The world's highest iron-ore mine has recently been opened up on the slopes of the Pamir Mountains in Central Asia at a height of 8200 ft. It will be connected with the nearest railhead by a 15-mile funicular railway.

Exports of coal from the British zone of Germany are to be cut by 350,000 tons in December and in each month of the first quarter of next year—a sharp increase on the reduction of 150,000 tons already made in October and again this month.

An Austrian-Russian oil trading company has, according to an official Russian announcement, recently been formed in Vienna with an initial capital of 2,500,000 schillings. It will set up branches and depôts in all parts of the country.

According to the American Iron and Steel Institute, production of steel ingots and castings during October reached the peace-time record total of 6,970,000 tons. This was the fourth successive month in which production exceeded 6,500,000 tons.

From East Africa comes the news that recent rains in the Kilimanjaro area have produced an excellent flush of the pyrethrum crop, but some growers have been unable to handle it adequately owing to the labour shortage.

The United States War Department has announced arrangements with nine commercial concerns to operate 15 ordnance nitrogen plants for the production of nitrate fertilisers, to be shipped to countries devastated by the war. About 70,000 tons of ammonium nitrate are expected to be produced monthly.

The reported existence of important iron-ore deposits in the Karelo-Finnish S.S.R., now confirmed, will make it possible to establish an iron and steel industry in the neighbourhood of Leningrad. Before the war, Leningrad industrial concerns relied on iron-ore supplies from the Urals and Southern Russia.

A Swiss method of electric smelting, stated to result in an improved product, is being put into operation at the Emmaboda window-glass factory in South Sweden and is expected to yield a monthly output of 200,000 square metres of glass.

The formation in Canada of an industrial alcohol company, Reliance Chemicals, Ltd., has recently been announced by Distillers Corp.-Seagrams, Ltd. Production has already started in plant units strategically located to serve industrial sections in Canada.

Producing ammonia and ammonium-nitrate-ammonia solutions, the nitrogen plant at South Point, Ohio, has been purchased from the United States Government by the Solvay Process Co., a subsidiary of Allied Chemical and Dye Corporation.

Holland is to receive iron ore, pyrites, **lead,** antimony, mercury and other raw materials from Spain under a new commercial agreement signed in The Hague recently. In exchange, Holland will deliver dyestuffs and other chemicals, metal products, etc.

A higher-potency penicillin, announced by the Heyden Chemical Corporation of America, is stated to retain its active properties for three years without refrigeration. It is in a white crystalline form, with a reputed potency of 1667 units per milligram.

The purchase of foreign copper by the U.S. Government is to be discontinued forthwith. This action is reported to have been taken because of the elimination of price ceilings. The current 4 cents per lb. tariff on copper will continue to apply to private imports.

Accident prevention in industry is the subject of a course proposed by the Victorian State Government in Australia, the purpose being to enable industrial concerns to train their own technical men in safety technique and to organise their plant on lines that will minimise risks.

Despite a small rise in U.S. domestic production of potash between June last and March next—estimated at 792,706 tons as compared with 780,184 tons in the same period of 1945-46—the supply is not expected to meet more than 60 per cent of the total demands of commercial fertiliser companies.

Export of bulk penicillin is now permitted in limited quantities under licence from the U.S. Department of Commerce. Domestic requirements of bulk penicillin for processing into the non-injectable dosage forms have now been exceeded by production, which, as a result of the development of more productive mould strains, has increased beyond the industry's capacity to process into the injectable form.

NEXT WEEK'S EVENTS

MONDAY, DECEMBER 2

Oil and Colour Chemists' Association (Hull Section). Royal Station Hotel, Hull, 6.30 p.m. Mr. M. D. Curwen: "Naphthalenes in War-time."

TUESDAY, DECEMBER 3

Institution of Chemical Engineers. Geological Society's rooms, Burlington House, Piccadilly, London, W.1, 5.30 p.m. Mr F. E. Warner: "Nitric Acid Production."

Society of Chemical Industry (Plastics Group). Chemical Society's rooms, Burlington House, Piccadilly, London, W.1, 6.30 p.m. Mr. E. G. Hancock: "Synthetic Resins from Polyhydroxy Phenols."

Hull Chemical and Engineering Society. Church Institute, Albion Street, Hull, 7.30 p.m. Mr. Edwin Davis: "The Jointing f Non-Ferrous Metals and Alloys."

WEDNESDAY, DECEMER 4

Society of Public Analysts. (Jointly with S.C.I. Food Group). Chemical Society's rooms, Burlington House, Piccadilly, London, W.1, 6.30 p.m. Mr. D. J. Finney, Mr. W. B. Adam, Dr. K. L. Blaxter, Mr. E. H. Steiner: "The Application of Statistical Methods to Food Problems."

Royal Society of Arts. John Adam Street, London, W.C.2, 5 p.m. Dr. L. H. Lampitt: "William Jackson Pope—His Times."

THURSDAY, DECEMBER 5

S.C.I. Chemical Engineering Group (jointly with Bristol Section of S.C.I). The University, Bristol, 5.30 p.m. Mr. J. W. Carter, "Industrial Application of Activated Alumina to Adsorption Drying."

Chemical Society. Burlington House, Piccadilly, London, W.1, 7.30 p.m. Professor M. Stacey: "Macromolecules Synthesised by Micro-organisms" (the Tilden Lecture).

Society of Chemical Industry (Manchester Section). Engineers' Club, Manchester, 6.30 p.m. Members of the staff of Benger's, Ltd.: "Enzymes in the Food Industry."

Royal Institution. 21, Albemarle Street, London, W.1, 5.15 p.m. Mrs. Kathleen Lonsdale: "What Chemistry Owes to X-Rays—Pt. 1."

FRIDAY, DECEMBER 6

Royal Institite of Chemistry (Liverpool and North-Western Section) (jointly with S.C.I., Chemical Society and B.A.C.). The University, Liverpool, 6.30 p.m. Dr. J. P. Baxter: "Atomic Energy."

Royal Statistical Society (London Group). E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, 6 p.m. Mr. W. Bennett: "Statistics in America—Factory Organisation."

SATURDAY, DECEMBER 7

British Association of Chemists. Adelphi Hotel, Liverpool, 3 p.m. Annual general meeting.

British Interplanetary Society. St. Martin's Technical School, Charing Cross Road, London, W.C.2, 6 p.m. Mr. John Humphries: "History of the 109-509 Rocket Unit."

Boring for oil in the Kimberley district of Western Australia will begin next April, according to a Commonwealth Government announcement. It is expected that the survey and drilling programme will extend from three to five years. A local company will soon resume drilling at Nerrima Dome, Kimberley.

Company News

The nominal capital of **Barrywald Products Ltd.**, manufacturers of electrical and chemical equipment, etc., 47, Oxford Street, W.1, has been increased beyond the registered capital of £500 by £3500 in £1 ordinary shares.

The nominal capital of **C.M.L. Ltd.**, research laboratory owners, etc., Ashley Green, near Chesham, has been increased beyond the registered capital of £100 by £4900 in 2000 non-redeemable cumulative preference and 2900 ordinary shares of £1.

The nominal capital of **A. Elder Reed & Co., Ltd.**, (226,982), chemicals, drugs, etc., 105, Battersea High Street, London, S.W.11, has been increased beyond the registered capital of £10,000 by £10,000 in £1 ordinary shares.

The nominal capital of **Diamond Fertiliser and Chemical Co., Ltd.**, 22/23, Corn Exchange Chambers, E.C.3, has been increased beyond the registered capital of £10,000 by £15,000 in 12,000 preference and 500 ordinary shares of £1 and 50,000 deferred shares of 1s.

New Companies Registered

Synthetic Chemicals Ltd. (223,986).—Private company. Capital £5000 in £1 shares. Manufacturers of and dealers in chemical substances, dyes, dyestuffs, paints, varnishes, etc. Subscribers: W. Hildreth, 80, North Park Avenue, Leeds, 8; K. Blackmore.

Chemical and Allied Stocks and Shares

STOCK markets have continued to reflect the search for investments offering larger yields than gilt-edged stocks. Although sentiment was unsettled by the latest UNO developments and profit-taking was in evidence in some directions, many industrial shares were again higher on balance. British Funds turned easier and selling of home rails was again reported, prices remaining below the "compensation" levels announced by the Minister of Transport.

After rising further to 44s. 3d., Imperial Chemical eased to 43s. 10½d., but Lever & Unilever at 51s. 6d. responded to the full results, and hopes of a higher dividend maintained firmness in Turner & Newall at 89s. 6d. On the other hand, the units of the Distillers Co. reacted to 137s. 6d. after changing hands up to 140s. United Molasses were 54s. 9d., British Plaster Board 33s. 6d. xd, British Drug Houses 58s., Fisons 60s., and Greeff-Chemicals Holdings 5s. ordinary 12s. 9d. B. Laporte were higher at £5. W. J. Bush 90s., Monsanto Chemicals 5½ per cent preference were quoted at 25s. 6d., Stevenson & Howell 5s. units at 31s., and Major & Co.'s 1s. units at 4s. 9d. Triplex Glass rallied to 36s. 9d. United Glass Bottle 87s. 6d. continued firmly held in view of higher dividend expectations, and Canning Town Glass 5s. ordinary were 12s. 4½d.

Iron and steels attracted buyers owing to the good yields still obtainable and the prevailing assumption that the industry is reprieved from nationalisation for about two years. Dorman Long at 27s. 3d. lost part of the rise which preceded publication of the financial results. United Steel were 26s. 3d. T. W. Ward 50s. 3d., Thomas & Baldwins units 11s. 3d., while in view of the unexpected increase in the interim dividend, Whitehead Iron & Steel were marked up 8s. 1½d. to 97s. 6d. Selective buying of colliery shares appeared to favour Bolsover (67s. 6d.), Hilton Main (47s. 6d.), Powell Duffryn (25s. 9d. xd), and Shipley (45s. 3d. xd).

In other directions, General Refractories 10s. ordinary have risen to 22s. on expectations that modernisation and expansion of the steel and other industries is likely to mean good demand for the company's products. Beechams deferred at 27s. 10½d. lost part of an earlier rise, but, in other directions, British Glues & Chemicals 4s. ordinary have further strengthened to 17s. 7½d. Low Temperature Carbonisation 2s. ordinary units have firmed up to 4s., and although best levels were not held in all cases, paint shares showed a number of good gains, Pinchin Johnson 10s. ordinary being 47s. 9d., while awaiting the dividend announcement, Lewis Berger have changed hands around £7. Electrical equipments were better with General Electric 103s., Associated Electrical 72s., while Crompton Parkinson strengthened to 34s. following news of the developments with the Austin Motor Co. in connection with electrical vehicles.

Borax Consolidated have been steady at 48s. 3d. reflecting continued hopes of a higher dividend for the past financial year. British Oxygen were good at 103s. 9d., with British Match 50s., and British Aluminium 45s. 9d. Boots Drug showed firmness at 63s. 6d., Timothy Whites were 47s., and Sangers 34s. Elsewhere, Morgan Crucible moved higher to 56s., and the company's preference shares were held firmly in view of their investment merits. De La Rue at 123 have not held best levels and British Industrial Plastics 2s. ordinary were 7s. 7½d. with Erinoid 5s. shares 15s. Following earlier gains, oil shares were affected by international developments, Anglo-Iranian easing to 98s. 9d. after touching £5, while Shell reached 94s. 4½d., but went back to 92s. 6d., and Trinidad Leaseholds moved back following the dividend announcement.

British Chemical Prices

Market Reports

A STRONG undertone continues to be maintained in practically all sections of the London industrial chemicals market. The continued pressure from home consumers exceeds available supplies while the flow of inquiries for export is sustained. In the soda products section hyposulphite of soda and chlorate of soda are in active request and among the potash products there is a ready market for all quantities offered. Elsewhere there is little change to report. There is also nothing of outstanding importance to report from the coal-tar products market, where supplies are inadequate to cover all current demands.

GLASGOW.—Conditions in the Scottish heavy chemical market have continued to be extremely active during the past week with a heavy demand for all classes of chemicals and raw materials. Shortages are still observed in a large number of materials and the supply position shows signs of deterioration rather than of improvement. Prices on the whole are very firm, with increases recorded for zinc and copper products. In the export market inquiries and orders for sulphuric acid, soda crystals, caustic soda, Glauber salts, calcium carbide, aluminium sulphate, and copper sulphate have been prominent, but here again the supply position is deteriorating and manufacturers are quoting for delivery at longer and longer intervals.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Chlorohydrin.—E. F. Chandley, H. Steiner, E. Zimkin, and Petrocarbon, Ltd. 31759.

Colouring hydrophobic substances.—Ciba, Ltd. 31707-8.

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Phenolic-alkyd resins.—Norton Grinding Wheel Co., Ltd. April 26, 1945. 9262/46.

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Cellular glass and the formation thereof.—Pittsburgh Corning Corporation. April 24, 1945. 7112/46.

Glass mixtures and process of forming same.—Pittsburgh Corning Corporation. April 24, 1945. 8761/46.

Glass mixtures and process of forming same.—Pittsburgh Corning Corporation. April 26, 1945. 7259/46.

Determining the concentration of a substance in a mixture. Pittsburgh Testing Laboratory. April 24, 1945. 11633/46.

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Hardening fatty acids and/or their glycerides.—De Nordiske Fabriker, De-No-Fa, A/S, and C. F. Holmboe. April 30, 1945. 11981-2/46.

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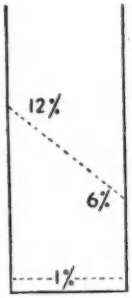

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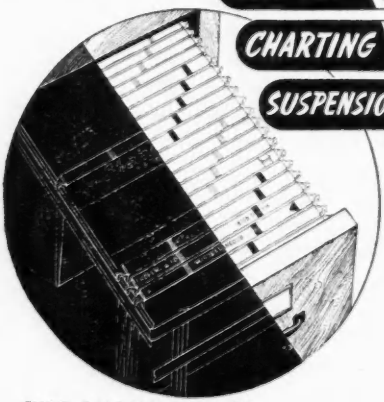

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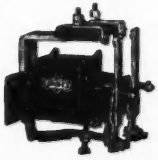

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